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THE ANCIENT POTTERY OF COLORADO, UTAH, ARIZONA, AND NEW MEXICO.

BY EDWIN A. BARBER.

FOR the purpose of exploring a comparatively unknown tract of country on the Pacific slope, in the far Southwest, supposed to abound in architectural remains of the ancient Pueblo race, a portion of the United States Geological Survey, in charge of Professor F. V. Hayden, was dispatched across the Rocky Mountains during the summer of 1875.

Over this vast extent of territory, covering probably two hundred thousand square miles, are strewn great quantities of broken pottery, which have lain exposed to the atmosphere for many centuries, and are still, for the most part, in a state of good preservation. So perfect, indeed, are many of the specimens, that they appear as though they had been molded and shattered to pieces but yesterday. This earthenware occurs most abundantly in the vicinity of ruins, where it often lies so thickly as to suggest the idea, which some archæologists entertain, that such places had once been the sites of huge potteries, where the ware had been manufactured on a wholesale plan. Upon a superficial observation I at first entertained this opinion, but after more careful and extensive investigations I discovered this to be erroneous. When we consider the fact that tons of this fragmentary crockery are scattered over hundreds of miles of this *mesa* country, it would seem as if some method had been employed for turning out great numbers of vessels by the agency of machinery; yet we ascertain that this was not the case, but that each piece had been fashioned by the hands of the *work-women*, and it seems highly probable that the inmates of each ancient household were their own potters. The employment of the plastic art was such a universal necessity that every family over this broad land con-

tained one or more skillful artificers. In the seven Moqui Pueblos of Arizona, I was fortunate enough to witness the modern operation as performed by the women of the tribe, and I doubt not that the method is very similar to the ancient. The vessel was first molded out of the plastic yellow clay, and, whether painted or not, was placed when dry in a small square aperture or oven, built in the side of the stone wall of the dwelling. There it was burnt until done; and I noticed in or near each of the Moqui houses several of these baking kilns, which were as important a part of the household as the fire-place or the ever-present flour-mill.

Around the bases of the mesas beneath the villages lay great quantities of damaged pottery, which had been accumulating for many years, perhaps centuries. Each vessel, as it outlived its usefulness, was cast over the bluff to swell the heap below. Thus among the ruins, we noticed in the walls of many of the structures square or cubical apartments in the solid walls, about eighteen inches in dimension, which had without doubt served the purpose of bake-ovens. It is not unreasonable to suppose, then, that every family produced its own utensils, and that in the course of a few years a considerable amount of rejected ware collected in the vicinity of each occupied building. In the immediate neighborhood of each house, be it large or small, this pottery abounds in greater or lesser quantity, so that were we to suppose one ruin or one locality to have once constituted a burning kiln, we must class all the structures under the same head.

As the result of a particular study of a great variety of specimens which we were unable to bring away, and also a subsequent examination of our own extensive collections, I have divided the ancient earthen ware of this region into five classes, namely:—

- I. The plain burned clay.
- II. The laminated or indented.
- III. The embossed or molded.
- IV. The glazed ware.
 1. *a.* Plain white.
 - b.* Ornamented in colors.
 2. Red or brick-ware.
- V. The glazed and corrugated.
 - I. This includes the most simple and probably the *oldest* pottery, made of common clay, usually coarse and unornamented.
 - II. The laminated class comprises all those varieties which are

indented, thatched, ribbed in parallel lines, or possess squamous, foliated, wavy, or pointed surfaces. The ware is generally of a lead or clay color.

III. This division embraces all the earthenware on whose surface have been molded or modeled figures of animals or fanciful designs which stand out in relief, the material being the same clay of which the vessel has been constructed.

Specimens of this class are very rare, and but few have ever been discovered among these ruins. I picked up the ends of several handles of utensils which had been molded into representations of the heads of animals and birds. The only specimen of any importance, however, found by the expedition was one I picked up in Montezuma Cañon, Utah. It was a perfect representation of a frog on the neck of a jug. (See Figure 20, Plate X.)

In the Reports of Explorations and Surveys, vol. iii., Pacific Railroad Report, Lieutenant A. W. Whipple (in his Itinerary, p. 65) mentions having seen two pieces of pottery with animal representations: "Upon one fragment, indeed, found upon Rio Gila, was pictured a turtle, and a piece of pottery picked up near the same place was molded into the form of a monkey's head.¹ These appeared to be ancient, and afforded exceptions to the rule."

IV. Under this class is comprehended all of the finer ware, which is highly glazed and frequently ornamentally painted in geometrical designs with durable colors, which are usually black, red, yellow, brown, and white. This variety is by far the most common and evidently the most recent, or at least not more ancient than the next class (V.), and represents the highest perfection of the art to which the ancient people attained.

V. When the second and fourth varieties are combined, the resulting vessels represent the most ornamental workmanship of the ancients. We occasionally see jars and vases of this description where one portion, as the neck, is laminated, while the lower parts are smooth and glazed. It is not seldom that a bowl or shallow dish is found whose interior surface is carefully painted and glazed, and whose exterior is indented. This indentation was evidently accomplished by a sharp instrument; after the scales

¹ The rude representation of this head may have been intended for that of any other animal, yet it seems that this people was acquainted with the tropical monkey, as we find to-day, among their rock inscriptions of upright figures, many with tails which could hardly be intended for anything else. — E. A. B.

or lines were marked out, they were pressed down symmetrically with the thumb of the maker, as we find much of this species of ware which exhibits the impress of the human thumb, the very minute lines of the cuticle being distinctly visible. Lieutenant Whipple advances the suggestion that this has been done by the pressure of a small shell, whose delicate lines have been retained in impression upon the exterior of the material after it has been hardened. But it can be readily seen how much more rapidly this ornamentation could be effected by the use of the thumb and fingers. In some varieties of this class of pottery, the plain surface of the vessel is covered by winding long strips of plastic clay around spirally, one edge of each whorl overlapping the next, and this is ornamented according to the taste of the maker. The most common method, however, is marking the surface off into pointed scales as described previously.

Captain Moss, who has lived among the western tribes of Indians for a number of years, informs me that some of the Ute Indians manufacture pottery at the present time, and as branches of the tribe extend into the district which abounds in these ancient mural remains, it is not singular that the process they still employ should resemble that of the modern Pueblo tribes of Arizona and New Mexico, of whom the former have probably learned the art. He says that for making their pottery "they use marl, which they grind between two rocks to a very fine powder. They then mix this with water and knead it as we would dough. Afterwards they roll it out into a rope-like shape about one inch in diameter and several yards in length. They then commence at the bottom of the jar, or whatever vessel they may be making, and coil the clay rope layer on layer, until they have the bottom and about three inches of the sides laid up. The tools for smoothing and joining the layers together are a paddle, made out of wood and perfectly smooth, and an oval-shaped polished stone. Both of these tools are dipped in the water (salt water is preferred), the stone is held in the left hand and on the inside of the vessel, and the paddle applied vigorously until the surfaces are smooth."

It is a very erroneous supposition, entertained by many, that the external indentation of Class II. has been effected by molding the vessel around the interior of a wicker-work basket, which has afterwards been burned away in the process of baking, leaving the laminated impression of the woven twigs. At first, this explanation seems plausible, but on careful examination I could find

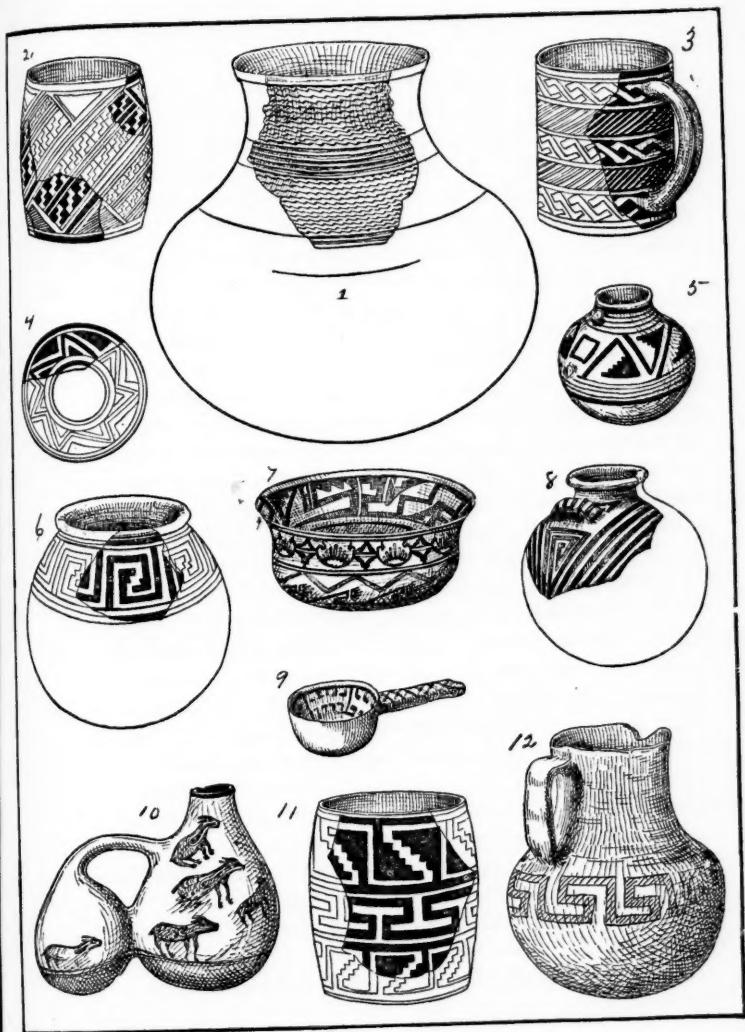


PLATE IX. ANCIENT POTTERY OF COLORADO, ETC.

not the slightest indication that this method had been followed; some of the vessels, however, may have been molded over gourds, which will account for their symmetrical appearance, especially on the interior.

The figures of ornamentation in the glazed ware are usually geometrical combinations of straight and curved lines, or fanciful designs, which, in some cases, exhibit a great degree of proficiency in the art. From the first rude attempts of the beginner, in which the end of the finger has simply been dipped into the pigment and pressed in places on the object, to the finished patterns of the "walls of Troy," or even more intricate designs, we can trace a gradual but steady advancement. It has been said that few or no representations of animals are to be found through this ancient pottery. In Eastern Utah, however, near a stream called Epsom Creek, a northern tributary arroyo of the San Juan, one of our party picked up a fragment of ancient pottery having on its convex surface a painted representation of an animal,¹ which was most probably intended for an elk. (Figure 21, Plate X.) This is reduced to one third of the original. Such specimens of ancient production are exceedingly rare, although the *modern* ware of the Moquis, Zuñis, and Pueblos is profusely decorated with such pictures. One of the most noticeable facts in connection with these ancient clay utensils is to be observed in the manner of ornamentation; for in some fragments we observe the painted figures on one side only, and in others on both. I have observed that in those pieces of vessels which, from the general contour or curve, are seen to have originally been such as possess a small neck or mouth, as a jug or jar, whose exterior surface alone would be exposed to view, the painted designs are worked only upon the convex side; on the other hand, those vessels which originally were open and shallow, as a bowl or dipper, were ornamented on the concave surface, as the under side would not be exposed. Again, it is noticeable that those vessels, such as vases and pots, whose sides, when entire, would have been upright, but whose mouths would have been broad and open, exposing equally the interior and exterior surfaces, were invariably painted on *both* sides.

In many pieces which lie scattered over the desert (perhaps

¹ Plate VII. Figure 1, was probably intended for a wild goat. The original painting was, possibly, as I have supplied the missing parts in the dotted lines. It was produced by a clumsy hand, yet I am satisfied that it was designed to represent an animal of some sort, forming a very good example of aboriginal caricature.

ten per cent. of all the pottery found) there have been drilled small circular holes, which have evidently been made for the purpose of tying two or more broken fragments together when the vessel has been put to further use. Those perforations showing a funnel-like shape (as in Plate VII., Figure 2), with concentric rings, have been formed by the stone "rimmer" or sharp "borer." And we can see that in the majority of such cases the small circular orifice has been sunk *from the outside* or convex surface, as the opening there is larger than where it terminates on the interior.

The earthenware utensils, according to their original forms and uses, may be classed under three heads: I. Sepulchral urns. II. Water vessels. III. Food receptacles.

The first division comprises vessels or *ollas* without handles, for cremation, usually being from ten to fifteen inches in height, with broad open mouths, and made of coarse clay with a laminated exterior (partially or entirely ornamented). Frequently the indentations extend simply around the neck or rim, the lower portions being plain. The second class includes jars, vases, jugs, pots, dippers, ladles, cups, mugs, saucers, and many other forms closely resembling our modern china. The third group consists of bowls, basins, and variously shaped dishes.

Sir John Lubbock, quoting Mr. Bateman's description,¹ says of European pottery, "'The urns generally accompany interments by cremation, and have either contained, or been inverted over, burnt human bones. They are generally of large size;'" Sir John Lubbock continues, they are "from ten to sixteen inches high, with a deep border, more or less decorated by impressions of twisted thongs and incised patterns in which the chevron or herring-bone constantly recurs in various combinations, occasionally relieved by circular punctures, or assuming a reticulated appearance. They are all made by hand, no trace of the potter's wheel being ever found on them. They almost invariably have an overhanging rim. The material of which they are formed is clay mixed with pebbles, and some of them have been described as 'sun-dried.' This, however, appears to be altogether a mistake, arising from the imperfect manner in which they are burnt. In color they are generally brown or burnt umber outside and black inside."

This description of the pottery (burial urns) of Europe will apply in every respect, with the one exception of ornamentation, to that of the West.

¹ Prehistoric Times, page 165.

In many fragments of the mouths of jars a horizontal projection around the inner circumference of the lip is noticeable. (Plate VII., Figure 3). This, no doubt, was intended for the resting-place of a lid, and indeed we find many of these scattered through the *débris* of the ruins. The most ordinary form of lid is a simple flat circle (Plate VII., Figure 4) which fits closely into the mouth of the vessel. Plate IX., Figure 4, shows another discoidal lid. Mr. Holmes found, in an old ruin in the Mancos Cañon, two vessels with their lids fitted into them. He remarks, "Roughly-hewn *stone* lids were fitted carefully over the tops, but both were empty. One had been slightly broken about the rim, while the other had been pierced on the under side by some sharp instrument, and had been mended by laying a small fragment of pottery over the aperture on the inside and cementing it down with clay. They are of the ordinary corrugated pottery, and have a capacity of about three gallons." An improvement on this is the lid with a central button (Plate VII., Figure 5), by which it can be lifted more readily. Advancing in the scale of improvement we find the ornamental knob which is suggestive of our modern sugar-bowl top. Plate VII., Figures 6 and 7, will show two other varieties of ancient lids.

Nearly every article of household ware was adorned with one or more handles, and these, being so very numerous, present the greatest possible diversity in shape, design, size, and finish. There is the straight, long handle of the dipper, either plain or fanciful; there is the semicircular handle of the mug or cup, and the circular loops of the water-jug. All these general forms are so varied that it is seldom that two are found of like patterns. It is very evident that this ancient race was particularly partial to handles, and every vessel upon which a handle could be placed was supplied with one or more. These usually had been hollowed out when the clay was still damp, by thrusting sticks or straws through their centres, as may be proved by the impressions left in the clay. This was done, no doubt, for the purpose of making the vessel as light in weight as possible. Occasionally, however, we discover a handle which is solid, especially when it is slender or curved. The extremities of some of these were, as previously mentioned, occasionally molded into representations of the heads and ears of animals or beaks of birds. (Plate VIII., Figure 2, representing an owl; see also Plate XI., Figure 10.) Often the glazed appendages were painted in various designs. A very curious and ingenious contrivance was picked up among

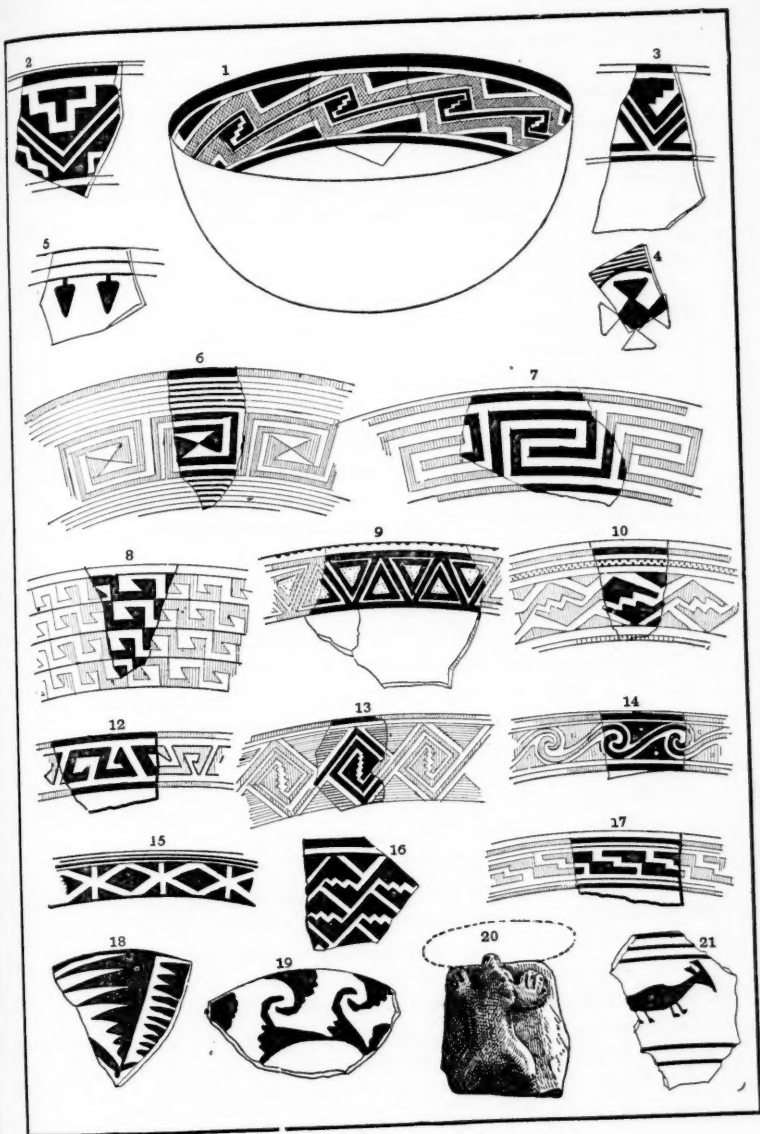


PLATE X. ANCIENT POTTERY OF COLORADO, ETC.

the ruins of Utah, by one of the members of the United States Geological Survey. It was a combination of a handle and the neck of a jug. (Plate VII., Figure 8.) Across the middle of the opening of the vessel extended a hollow clay tube, separating the mouth into two divisions. Through this a thong was passed, by which the jug was carried or suspended from the walls of the house. Plate VIII., Figures 3-8, represents some common forms of handles, the straight ones (Figures 6-8) being the most numerous, though usually the most fragmentary. Plate VIII., Figure 5, represents a handle made of three twisted rolls.

The material of the pottery of the aborigines consists of an infusible mixture of clay, which, after burning, is still opaque. There is always a great percentage of silicious earth, which is increased as the vessel is designed to be firm or less liable to shrink or crack on exposure to heat. Pulverized flint or quartz was probably much used in the ancient pottery. Captain John Moss states that he was informed by some of the Moquinos of Arizona that the older glazed pottery was made from a certain species of white rock, pulverized and worked into a paste, but the modern people have never been able to discover from whence the material was obtained. If such was the case, the process is now one of the lost arts of the Moqui, Zuñi, and Pueblo tribes. It is probable that this ancient ware was made from pounded quartz, but the descendants of these old potters employ only what is at hand, that is, ordinary clay. The calcareous covering of mollusks could not have been used unless they were more abundant in those days than they now are.

The painting of the ware was accomplished before burning, and then the glaze was administered. The colors were made by pulverizing brilliant stones and earths.¹ Those used in ornamenting the glazed crockery were black, white, yellow, brown, and red; and I have picked up pieces which presented greenish or purplish tints, although these may be accounted for by the fading of the coloring. The pigment was administered to the vessel before baking, and frequently the action of heat might have altered the chemical nature of the original hues. The glazing

¹ Mr. Foster, in his *Prehistoric Races of the United States*, says, "Professor Cox was informed that the New Mexican Indians colored their pottery black by using the gum of the mezquite, which has much the appearance and properties of gum arabic, and then baking it. Much of the ancient pottery from the Colorado Chiquito is colored, the prevailing tints being white, black, and red." Gregg, in his *Commerce of the Prairies*, says that this pottery was also colored with the juice of a plant called guaco.

was not calcareous, as it does not effervesce under acid, or, if at all, only slightly and in particular places, so that in all probability salt was used for glaze, as this mineral occurs abundantly throughout the country, both in a solid form and in solution in the waters of many of the springs, frequently combined with a little lime. Adair, in his History of the American Indians, describes a method of glazing employed by some of the southern tribes of our country. They place the vessels over a smoky fire of pitch-pine, which gives them a smooth, black appearance, as of enamel.

Some of the ancient pottery may have been shaped by the operation of casting, for no indications of the potter's wheel or lathe can be discovered. Beyond doubt a portion of the ware was formed by molding, and in some instances the lower halves of small-mouthed vessels were shaped in a matrice or between two molds, while the upper portions, including the neck and handles, were finished more rudely by hand. This peculiarity may be seen in many broken fragments where the interior of jugs is exposed to view. In several dippers which I have before me I can readily perceive that the handles were modeled over cylindrical sticks, somewhat greater in diameter than an ordinary lead pencil, and, previous to completing the end, the stick was withdrawn, leaving fine parallel lines and ridges around the interior of the hollow tube. Then a piece of clay was added to the extremity, and rounded and smoothed into shape.

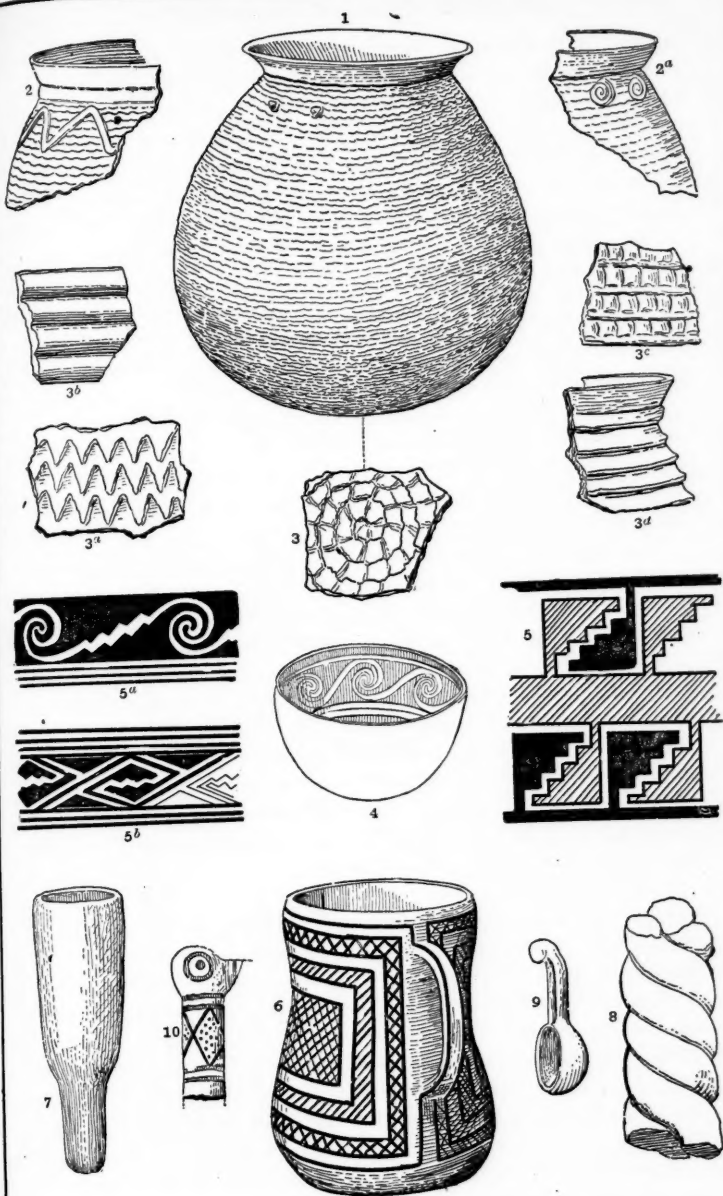
In fact, though these prehistoric people were considerably advanced in some of the useful arts, and were cognizant of the general principles by which they were employed, they were sadly ignorant of the use of tools, even of the most simple patterns; and yet, to-day, tons of this hand-made pottery may be gathered through the cañons of the far Southwest. This class of fictile fabrics resembles more closely the modern ware of civilized peoples than that of any other aboriginal or ancient tribe, in the forms of the vessels, the symmetrical finish, the coloring, glazing, the manner in which it has been baked or burnt, and the quality of the ware. It exhibits a greater advancement in the ceramic art, and shows that those people who manufactured it were well along in civilization. It is entirely different from any of the pottery of other ancient tribes, especially of those Indian tribes east of the Rocky Mountains; and in the quantity which was made, it stands *alone* in the annals of prehistoric man.

Plate IX., Figure 5, represents a very perfect specimen of

ancient ware found in the Pueblo de Chelly; it is about three and a half inches in diameter, symmetrically shaped, and accurately painted. It is, indeed, one of the most perfect and best finished specimens which has ever been brought from the West.

Plate VIII., Figure 9, represents a fragment of a jar of the indented ware; Plate VIII., Figure 10, a portion of an ancient dipper, and Figure 11 a rare piece of pottery, ornamented in white on a smooth, black ground. This ornamentation has been accomplished, doubtless, in part or wholly, by stretching twisted thongs and straws across the surface and painting over the whole. This leaves the lines of white spots and the stripes. The original vessel was a large one (probably a foot and a half in diameter), and much labor must have been expended in its ornamentation.

Occasionally the ancient potters applied the decorative art to the entire external surfaces of vessels. Figure 12, Plate VIII., shows a portion of the bottom of an urn of the indented variety, in which the design consists of impressed lines alternating in series of circles and rows of scales. In this specimen the ornamentation has been accomplished, the circles by the pressure of a sharp or pointed instrument, and the rest by means of the side of a rounded stick at regular intervals, and finished by the thumb of the maker. This bottom is generally convex but somewhat flattened at the centre, so that the original jar would stand on a level surface without support. In another specimen of a water vessel I observed eight small notches or cuts close together on the edge of the rim, which had evidently been filed there with a sharp or serrated instrument of stone. These I believe to have formed a tally or score, perhaps registering the number of times the vessel was filled at the spring on some particular occasion. Figure 1 of Plate IX. represents a fragment of a jar, and the reconstructed vessel found in the valley of Epsom Creek, Utah. It is of the indented ware, and was made by winding narrow strips of clay spirally, one edge of each whorl overlapping an edge of the next. The scaled appearance was produced as usual by indentations of the thumb, and for variety several rows were often left untouched. The dimensions of the original were about eighteen inches in diameter and height, and half this distance across the mouth. Figures 2, 3, and 11 show the original forms of restored mugs or cups. Figure 3 is a particularly fine example of this style of vessel, having a double handle. These average four inches in height. Figure 6 is a fragment of an urn possessing a recurved lip. The entire vessel was probably ten



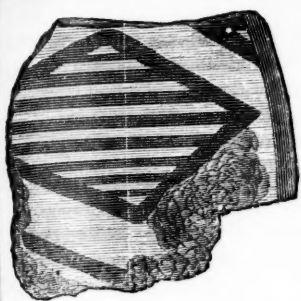
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PLATE XI. ANCIENT POTTERY OF COLORADO, ETC.

inches in diameter, the mouth being five inches across. Figure 8 represents a diminutive jug which I dug up at Aztec Springs. In it I found a number of fragments of burnt corn-cobs. It had two opposite handles near the neck; the diameter of the globular vessel was about four and a half inches, and an inch and a half across the mouth. Figure 9 shows a common utensil shaped like a dipper or ladle. This particular specimen was picked up in Montezuma Cañon, Utah, and measures across the bowl three and a half inches, the handle being four inches long. Figure 12 is an exceedingly interesting vessel exhumed from an ancient grave of the Mancos by Captain John Moss. Several similar pitchers were taken from the same tomb, together with some polished stone implements and a human jaw-bone. Figures 7 and 10 are modern. In Plate X. the majority of figures represent fragments from bowls, similar to Figure 1. This form of vessel seems to have been particularly abundant, varying in size from two inches to two feet in diameter. They are highly glazed and painted usually on the inner surface, though sometimes they are ornamented both internally and externally. This plate is intended to illustrate some of the more artistic designs which are found on much of this ancient pottery. Figure 4 shows a Maltese cross, a figure which is quite common in the inner centre of the bottoms of bowls. Many such designs were picked up, and they have been found in ruins a hundred miles apart. Figure 9 is a fragment of a bowl whose rim was originally thirteen inches in diameter. This is the largest specimen of the finer glazed ware discovered by the party. Figures 13 and 14 are particularly well executed. This ware is firm and hard, and never exceeds a half-inch in thickness. Figures 18 and 19 are portions of smaller bowls or cups of five inches diameter.

Mr. W. H. Holmes says of the pottery of the Mancos, "The study of the fragmentary ware found about the ruins is very interesting, and its immense quantity is a constant matter of wonder. On one occasion, while encamped near the foot of Mancos Cañon, I undertook to collect all fragments of vessels of manifestly different designs within a certain space, and by selecting pieces having peculiarly marked rims I was able to say with certainty that within ten feet square there were fragments of fifty-five different vessels. In shape these vessels have been so varied that few forms known to civilized art could not be found."

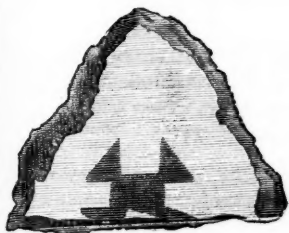
Figure 1 of Plate XI. is a large corrugated jar with a capacity of about three gallons. The vessel was commenced at the



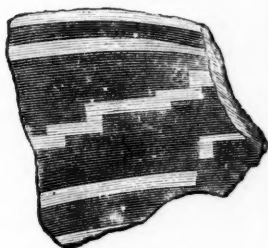
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1.



3.



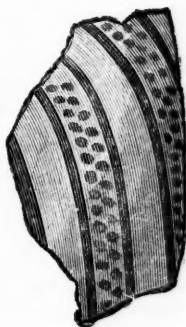
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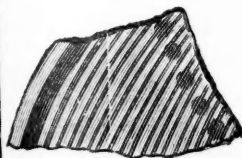
7.



4.



2.



8.

PLATE XII. ANCIENT POTTERY OF COLORADO, ETC.

centre of the bottom (see Figure 3) and built up by winding a strip of clay spirally until the rim was finished. Two ornamental rosettes of clay were placed near the rim in lieu of handles. Figures 3 *a*, 3 *b*, 3 *c*, 3 *d*, and Figures 2 and 2 *a* are other styles of indented ware. Figure 4 is a reconstructed bowl painted on both sides, and is an excellent example of careful workmanship. Figures 5, 5 *a*, and 5 *b* are other samples of ornamentation. Figure 6 shows another mug, slightly different from Figures 2, 3, and 11 of Plate IX. It has curved sides and a differently shaped handle. Figure 7 Mr. Holmes supposed to be a pipe, two inches in length. Figure 9 is a small clay ladle, and such utensils seem to have been numerous. I picked up one whose bowl was about two and a half inches in diameter, but the handle was wanting.

Different, peculiar, and interesting forms of this fragmentary ware might be described sufficient to fill a volume, but those already given will suffice to convey a general idea of the more important features of the ancient plastic art of this section.

I am indebted to Prof. F. V. Hayden for the use of Plates IX., X., XI., from Bulletin Vol. II., No. 1, Geological and Geographical Survey of the Territories. The majority of the original specimens here figured are at present in the collection of Professor S. S. Haldeman, by whom they will probably be placed in the museum of the Academy of Natural Sciences of Philadelphia, at no very distant day.

EXPLANATION OF PLATES VII, VIII, AND XII.

Plate VII. Figure 1. Rude representation of the Rocky Mountain sheep or goat on ancient pottery. Figure 2. Pottery showing orifices bored with a rimmer. Figure 3. Horizontal mouth of a jar. Figure 4. Jar-lid. Figure 5. Top of lid. Figure 6. Top of lid. Figure 7. Top of lid. Figure 8. Neck and handle combined.

Plate VIII. Figure 2. Owl's-head handle. Figures 3-8. Curved and straight handles. Figure 9. Ancient jar reconstructed. Figure 10. Portion of a dipper. Figure 11. A rare pattern. Figure 12. Bottom of indented vessel.

Plate XII. Figures 1, 2. Fragmentary ware. Figures 3, 4. From the bottoms of vessels. Figures 5, 6, 7, and 8. From the rims of vessels. All three fifths natural size.

A NEW CALIFORNIAN DEER.

BY HON. J. D. CATON.

IN a recent visit to California I met with a new variety of deer (*Cervus macrotis*, var. *Californicus*), a description of which may be interesting to the naturalist; I say new because I find it nowhere mentioned in print, nor could I learn that hunters or sportsmen had observed its peculiarities.

Before my arrival at Santa Barbara the fame of Mr. Frost, the leading merchant of the place, as a deer-hunter, had reached me, and soon after my arrival I made his acquaintance and inquired concerning the deer of the vicinity. He showed me many interesting specimens of antlers, a few dried skins, and a last year's fawn in domestication, but unfortunately the tail of the latter had been bitten off by a mule.

I saw at once that we had something I had never met before or seen described. I expressed a strong desire for an opportunity to study it further, when Mr. Frost invited me to join him in an excursion to the mountains to procure a specimen, which of course I gladly accepted. At six o'clock on Tuesday morning, the 21st of March, he drove up to my hotel, accompanied by Mr. Miller, another merchant of Santa Barbara, no less fond of the chase, the wagon stored with every convenience for camp life. We followed up the coast forty miles to Gaviota, where we crossed the Coast Range through the Gaviota Pass, the summit of which I found to be one thousand and fifty feet above the sea, and made camp in a secluded valley, among abrupt hills varying in height from one hundred to four hundred feet. Some of these were covered with wild oats to their very summits, while others were clothed with open, park-like live-oaks, or dense chaparral. The afternoon was spent in making camp, observing the character of the country, and listening to the love notes of the great flocks of quail (*Lophortyx Californicus*), whose breeding season was about to commence.

Next morning by daylight coffee was drank, and the hunters were off to the hills. As the excursion was strictly for scientific purposes, it was understood that only bucks were to be shot at. By noon three specimens were brought into camp, which were all I desired, and afforded me every opportunity for a critical study.

I found them to be a very pronounced variety of *Cervus macrotis*. Of the species there could be no mistake. There was the large ear, the very large metatarsal gland, more than four times as large as on the black-tailed deer (*Cervus Columbianus*), and more than ten times as large as on the common deer (*Cervus Virginianus*), but above all the under side of the tail was naked to about the same extent as on the tail of the horse. Now this is a peculiarity not found on any other of the American deer, and I do not know that it is observed on any foreign species; and as it is as constant on this deer as on the horse, it becomes an impor-

tant specific character, and, had other important similitudes been wanting, would have gone far to identify the species. I will not stop to point out other features peculiar to *C. macrotis*, but will rather describe the differences between this variety and that found east of the Sierra Nevadas.

Those found in the low altitudes where we made our camp are hardly as large as those found on the high table-lands east of the Sierras and in the Rocky Mountains, but I learned that those found in the higher mountains, say five thousand feet or upwards above the sea, are very large. Mr. Frost once killed one in the high mountains which was believed to weigh four hundred pounds. This deer frequents higher altitudes than any other deer, being frequently found above the timber line. I have not the means of comparing those found at San Julian (that was the name of the ranch on which we made our camp) with any living on so low an altitude elsewhere. In color these deer had a decidedly more reddish shade than those east of the Sierras, much more approaching the color of *C. Columbianus*. Those, however, found in high altitudes were described as of the dull gray color of the eastern variety. On the mule deer (*Cervus macrotis*), there is a snow-white section which commences just above the root of the tail and extends down the buttock for several inches on each side to nearly the length of that member. This white section on the specimens of the California variety which I examined was not quite so extensive as on the eastern variety, though in all other respects they were identical. But the most marked distinction of this new variety was in the markings of the tail. On all the specimens I have examined or heard of east of the Sierras, the tail of *C. macrotis* is entirely white except a tuft of long hairs at the extremity, which is black. On all that I examined west of the Sierras a dark line extends down the upper side of the tail, and unites with the black tuft at the end. This line varied in depth of color on different specimens, but was always very distinctly present, never of a lighter color than on the back above, but frequently considerably darker as it approached the black tuft, always showing many tawny hairs, which in several specimens invaded the tuft at the extremity; this on the eastern variety is always entirely black, except in summer, when it sometimes fades to a reddish shade. It was this dark line down the upper side of the tail which first attracted my attention on the dried skins examined, and excited the suspicion that this might be a new species of deer, which, however, was at once dispelled

when I had opportunity for more careful examination. This mark, I learned from Mr. Frost and many others, is as constant on the large specimens found in the higher altitudes as on the smaller ones found at less elevations near the coast. It is uniform and constant, so far as I could learn, on all found west of the Sierras.

At first I suspected a relative of *C. Columbianus* rather than of *C. macrotis*, but when I observed that the dark line on top of the tail did not embrace more than one third of its circumference, while on the black-tailed deer all is colored except one quarter or one third on the under side, which is white, — in fact, that this is a white tail with a colored line on top, and the other is a black tail with a white line along the under side, — but above all, when I found the under side of the tail naked, while the tail of *C. Columbianus* is covered with a dense coat of hairs on the under side to the base, I saw at once it was no relative of the true black-tailed deer.

This was confirmed by observations made a few weeks later, when enjoying the hospitality of Mr. A. E. Kent, near San Rafael, north of San Francisco. Mr. Kent has a deer park inclosed in an admirable locality, and has in it four does and a buck, and felt sadly disappointed that the does had never bred. The first glance disclosed the cause of this sterility. The does were all of the true black-tailed deer, while the buck was of this new variety of the mule deer. When I pointed out the difference, he readily recognized it. The larger ears, the longer and coarser legs, the larger gland on the hind legs, and the difference in the form and color of the tail, were all very plain when pointed out, though he had not noticed them before, albeit there are but few if any more persistent deer-hunters in California, and none who have more carefully studied the habits of the deer in everything essential to the successful chase. Had the colored stripe on the upper side of the tail been wanting, as on the eastern variety, he would no doubt have observed the difference at once. The does were natives of the country north of him; the buck was presented to him by a friend, but he did not know whence he was procured; I expressed the opinion that he would on inquiry find that he came from the south, which he has since informed me was the case. I examined thirty or forty dried skins, the fruits of the chase by Mr. Kent, all procured north of San Francisco, along the Coast Range, within the distance of one hundred and fifty miles. Not one from a mule deer was found. All were from the black-tailed deer.

I lack the necessary information to enable me to determine the extent of the habitat of this variety of the mule deer. I think it safe to say that it predominates in the Coast Range south of Montera, and probably south of San Francisco, while it is rarely if ever met with in the Coast Range in California north of San Francisco. Good observers report *C. macrotis* in the Coast Range in Oregon, though of rather a small size, and I have most satisfactory evidence that it occurs abundantly in the Sierras in Northern California; but whether these are of the variety I have described I have no means of determining. I hope this article will induce naturalists and observers on the west coast to examine with critical care specimens from the various localities and let us have the result of their observations, so that this question may be determined. I expect that we shall find that the Sierras are the dividing line between the two varieties of *C. macrotis*.

I am informed by Professor Baird that the Smithsonian Institution some years since received several skins from Cape St. Lucas, of a very small variety of *C. macrotis* inhabiting the peninsula of California, with spike antlers, which were said to be fully adult, and not yearlings with dag antlers. Those skins were unfortunately destroyed, so that I could not examine them. I have thus far failed in my efforts to procure specimens from that locality. Mr. Burton, of Santa Barbara, who forty years ago hunted the sea otter along that coast, informed me that he found a very small variety of deer quite abundant on the island of Santa Margarita, off the coast of Southern California; but he could not describe it except that it was of diminutive size and quite abundant.

As soon as the deer reached camp I selected a fair specimen, a buck, which I judged to be four years old, and prepared the skin and necessary parts of the skeleton for mounting. This I subsequently sent to the Smithsonian Institution. Professor Baird has expressed much interest about it, and assured me that it would be mounted and added to the collection of American quadrupeds at the Centennial, where those who take an interest in these studies may examine and compare it with others.

After our work was done we enjoyed a most leisurely feast of venison prepared in all the different modes most approved in camp, sweetened by long absence and hard toil. After a late breakfast the next morning, in which venison was again most prominent, we leisurely broke camp and I bade farewell to one of the sweetest nooks for such a purpose I have ever seen. The

rank wild oats which formed our beds, the bowers of flowering shrubs which loaded the air with a rich perfume, the music of the mountain brook which went dancing down near by on its way to the great Pacific, soothed to sleep at night and bade a pleasant welcome in the morning.

A NEGLECTED NATURALIST.

BY HERBERT E. COPELAND, M. S.

TO many of the untiring naturalists who fifty years ago accepted the perils and privations of the far West, to collect and describe its animals and plants, we have given the only reward they sought — a grateful remembrance of their work. Audubon died full of riches and honor, with the knowledge that his memory would be cherished so long as birds should sing. Wilson is "the Father of American Ornithology," and his mistakes and faults are forgotten in our admiration of his great achievements. Le Sueur is remembered as "the first to explore the ichthyology of the Great American Lakes." Laboring with them, and greatest of them all in respect to the extent and range of his accomplishments, was one whose name has nearly been forgotten, and is oftenest mentioned, in the field of his best labors, with pity or contempt.

The early field-naturalists had very imperfect conceptions of the relationship existing between closely allied forms, — for the necessary comparison can be made only after the accumulation of more specimens than are ever collected by one man, — and they therefore described as "species" forms due to geographical influences or individual peculiarities. Who among them erred most in this direction cannot yet be determined, for our own knowledge is too imperfect, a fact readily appreciated by those who have followed scientific thought at all closely for the last few years. We may, therefore, now pass judgment only on the honesty and truthfulness of these investigators, and for this we have two sources of evidence: first, the testimony of contemporaries; second, the testimony of their work. On the first head we have in regard to the subject of this sketch, the most emphatic statements from his friends and co-laborers, Swainson and Audubon. If there be anything recorded against the integrity of his intentions, diligent research has failed to reveal it to me. It is my present purpose to present an outline of his work, for the consideration of the candid reader.

C. S. Rafinesque was one of the geniuses that occasionally appear, to puzzle people of steady habits. His early life was full of the vicissitudes which may be told of nearly every pioneer in American science, and he was thrown on our shores for the second time from a shipwreck in which he had lost every tangible result of his labors in science; the sea had taken everything but hope and energy. Similar misfortunes have since broken the spirit of more than one student of science, but whatever cloud these may have cast over the mind of Rafinesque, it did not affect his zeal and capacity for work, and the result was so prodigious that I confine myself to a consideration of his labors in ichthyology, since here he has received most blame from recent followers, and pass by his work in the other branches of science with only a statement of the result.

He proposed a natural system of classification in botany at a time when the Linnæan system was as universally recognized in this country as is the binomial nomenclature now. Thirteen genera, eight subgenera, and sixteen species of the plants referred to in Gray's Manual are his. His writings on conchology have been considered worth editing by Binney and Tryon. Of our reptiles and batrachians, four genera and six species bear his name. He described four genera and four species that are retained in the current literature treating of our mammals. The genus *Helmitherus* of birds was proposed by him. There is implied in this brief outline an amount of labor to be appreciated only by those who themselves are laborers.

In 1820, the year in which Maine was admitted to the Union, when the population of the United States was about nine million, and the population of Cincinnati was nine thousand, there was published at Lexington, Ky., "for the author," C. S. Rafinesque, a little octavo book of ninety pages, with the following title: "Ichthyologia Ohiensis, or Natural History of the Fishes inhabiting the River Ohio and its Tributary Streams. Preceded by a Physical Description of the Ohio and its Branches," and with the following motto:—

"The art of seeing well, or of noticing and distinguishing with accuracy the objects which we perceive, is a high faculty of the mind, unfolded in few individuals, and despised by those who can neither acquire it nor appreciate its results."

The book is now very rare, the borrowed copy before me, although worn and faded, being valued at fifty dollars, so that it is very difficult to verify a reference to it or to consult the original

descriptions. This may have led European writers, intrenched in the conviction that no traveling naturalist could invalidate or even anticipate the labors of a Cuvier or a Valenciennes, and even frankly stating that "the natural history of North American fresh-water fishes is in its infancy, and only a small proportion of the literature pertaining to it has been critically examined," to believe that they could afford to reject all of Rafinesque's work, and then coin such contemptuous expressions as "Rafinesquian genera" for groups rejected without examination. I may say here, however, that the term is not a reproach to those acquainted with the value of the work, for Rafinesque was the first writer on American fishes who distinguished with even tolerable accuracy those groups now called genera, and for thirty-five years after him there was no writer on our fishes of whom Professor Agassiz's words are not true, that "most of their generic descriptions are only vague specific descriptions, and their specific descriptions refer chiefly to individual peculiarities of the specimens before them."

American writers who have neglected Rafinesque may plead the same difficulties in extenuation, but have in some cases, I am willing to believe, been influenced more by the habit of neglect toward him. As a fisher in the streams tributary to the Ohio I have become profoundly impressed by the accuracy of the work he did when laboring under so many disadvantages. He was surely indefatigable in collecting, and more accurate than the custom and habit of his time demanded. The general confusion characterizing so much of the literature on the fresh-water fishes of the United States may afford some reason why no one has made a distinction, in the case of Rafinesque, between the descriptions from specimens he had seen and those based on the report of others. The failure so to distinguish, added to the unfortunate results of the well-intended attempt at identification by one or two western ichthyologists, and the consequent lack of confidence when the discrepancies were proved, has led to the rejection of nearly all his work and to the addition of many useless synonyms to our nomenclature.

Rafinesque referred a few fishes conjecturally to genera on the testimony of others, when he had never seen a specimen. These may be dropped without remark or prejudice, in accordance with the universal custom.

He gave descriptions of some very singular fishes from drawings by John James Audubon. Whatever blame there may be

belongs to the artist. It is scarcely necessary to say that Audubon's paintings of birds are wonderfully accurate, and that his skill and truthfulness as a field-naturalist were such that one of his descriptions is considered to be worth respect, even if contradicted by his best successors. Rafinesque had particular reason to trust him, for on his denying the existence of a flower Audubon had painted, he was led to discover a new genus. Such proof was not always possible, and why should he doubt the existence of a fish painted in its life colors by the same gifted hand? Valenciennes and Richardson have described species of fishes that yet hold a place in so celebrated systematic literature as the Catalogue of the Fishes of the British Museum, from Chinese drawings. We may be pardoned for retaining the descriptions of Rafinesque from the paintings of Audubon; we may surely drop them without reproach to the author.

His descriptions of the fishes he collected cannot, in many particular cases, be surpassed, and are generally recognizable even among the cyprinoids or minnows, where, on account of their close resemblance to each other, there has always been the most confusion. The first good word was spoken for him by Kirtland, but the value of his work was not fully recognized until 1856, when Professor Agassiz was receiving collections from the tributaries of the Ohio. In his *Fishes of the Tennessee* he restored many of Rafinesque's names, and defended his memory against the harsh treatment it had received from the few writers who had noticed his work, expressing much regret "that his contemporaries did not follow in his steps, or at least preserve the tradition of his doings, instead of decrying him and appealing to foreign authority against him." After that time, however, Professor Agassiz made but few contributions to American ichthyology, and the general neglect continued to such an extent that a writer in the employ of the government took the trouble to describe badly many of the fishes that Rafinesque had described well, and in our own day authors have made new genera with descriptions no better than Rafinesque's for the same fishes.

Occasionally, however, as the fishes of the Ohio are becoming better known, one of his descriptions has been recognized, and recently Prof. David S. Jordan has published a thorough review of Rafinesque's work, based on collections of a large number of specimens from the streams in which he fished, and has restored many of his names. The result at last fully justifies all I say of this gifted ichthyologist, for of seventy-nine genera and one hun-

dred and fifteen species of fishes known as inhabiting the Ohio and its tributaries, twenty-nine genera and thirty-seven species were first described by him, and the eliminating of seasonal and sexual forms from the rank of species, and the identifying of more of his genera on a better acquaintance with the fishes of the Ohio, will constantly make the ratio greater.

I have not been actuated in the writing of this sketch wholly by a desire to see justice done. Professor Agassiz — and I quote him so often because he spoke so well before me in this matter — said, “Both in Europe and in America he has anticipated most of his contemporaries in the discovery of new genera and species in those departments of science he cultivated most perseveringly, and it is but justice to restore them to him whenever it can be done.”

But if we hold our duty lightly in regard to our treatment of these old naturalists, we are driven by our necessities to attempt the establishment of the oldest names that were accompanied by a recognizable description, for the nomenclature of our animals has become a matter so fearfully intricate that it has retarded in no slight degree the advancement of science, by repelling those naturally fitted for the work.

THE OCCURRENCE OF WHITE EGRETS AT TRENTON, NEW JERSEY.

BY CHARLES C. ABBOTT, M. D.

ON Monday, August 2d, 1875, it commenced raining early in the morning and continued day after day, with the exception of one day, until Friday, the 20th. The wind varied only from southeast to south. About ten and one tenth inches of rain fell, and in consequence the meadows bordering on the Delaware River were overflowed to a depth varying from two to six feet.

On the 14th of August a flock of thirty snowy herons (*Garzetta candidissima*) made their appearance, keeping much together, avoiding the clumps of tall trees, and at times associating very familiarly with a flock of domestic geese. Occasionally the great blue herons (*Ardea herodias*) were seen in scanty numbers, either alone or associated with the white herons, and every day there were numbers of the small blue herons (*Florida cœrulea*), but these excited no comment from those familiar with the locality, as they are quite abundant every year, as are also the night heron (*Nyctiardea gardeni*), the bittern (*Botaurus lentiginosus*),

the green heron (*Butorides virescens*), and the least bittern (*Ardea exilis*).

August 17th a small flock of white egrets (*Herodias egretta*) made their appearance, and associated familiarly with the white herons that had preceded them by three days. A tract of level meadows, of some seventy acres in extent, seemed particularly attractive to these birds, and I had excellent opportunities for watching their habits during their brief stay.

It is proper here to state that thirty years ago both of these species of white herons were quite common along the Delaware River from May to September, but they have now almost entirely disappeared, especially during the past six years, during which time I have failed to note their presence, except single specimens flying over.

My studies of the habits of birds during the past and preceding summers have frequently suggested to me that when any bird or flock of birds *deliberately* chose to frequent a very limited locality for a comparatively long time, notwithstanding the danger of the presence of man, their habits would indicate exercise of faculties that could not be considered simply instinctive; that the exercise of unusual care, forethought, and deliberation would be noticeable in their endeavors to avoid real or supposed dangers from the proximity of man. To what extent this is true is, I think, partly shown in the notes I have taken down in the field from August 14th to September 9th inclusive. How these movements should be interpreted the reader must judge for himself, but I think the explanation here given nearest in accordance with the facts, which I regret being unable to describe as clearly as I wish. Valuable as they undoubtedly are, written descriptions give but a faint idea of the varied movements and daily habits of our birds, which to be really appreciated must be seen.

It is very evident that these white egrets know that their color renders them quite conspicuous. I noticed every day the same movements on their part, which demonstrated their appreciation of this fact. They carefully kept in the centre of the tract of meadow, except when feeding, and then never ventured nearer than one hundred yards to the wooded margins of the meadow or near outstanding trees. This shyness, as it would be called, was not of itself at all remarkable, but as it was accompanied with another habit having direct relation to it, it was very curious, and indicative of thought. This second habit was

that of rising to a very great height always when passing over woods, as was necessary on coming in from the river, along the banks of which they appeared to roost. While the less timid blue herons would pass leisurely along the tree-tops, not a dozen yards above them, the white herons on being disturbed would rise rapidly to an unusual height, and, apparently keeping directly over the spot where they had been standing, would not commence an onward flight until the upward one was sufficiently prolonged to assure them that they were wholly out of harm's way. So when returning to the meadow they would, as it were, drop from the clouds, while the blue species would quietly wing their way along at a height of from ten to forty yards.

Now, inasmuch as no white egrets have, in any numbers, visited this locality for several years, and as in the Southern States they are little, if at all, more wary than the blue herons, it seems to me to follow necessarily that their peculiarity of flight, as instanced in avoiding supposed dangers, could not be hereditary, and was really an exercise of unusual care, forethought, on the part of these birds; a mental operation akin to thought in man, and having nothing whatever to do with instinct as understood by us.

Why, indeed, a flock of these egrets, for nearly four weeks, should frequent daily a tract of meadow so small as this of seventy acres, it would be very difficult if not impossible to determine; but such being the case, I naturally endeavored to mark their feeding habits carefully, and this, with the aid of a good field-glass, I was able to do. Their food consisted exclusively, while on the meadows, of frogs and grasshoppers, and especially of the latter, which were very abundant, and, having been caught by the freshet while in the long grass, were so wet and dragged that they could not escape by flight. The smaller herons seemed always occupied in gathering up the grasshoppers, and never stopped to plume themselves or take a quiet nap on one leg as the blue herons are so fond of doing. The egrets (*Herodias egretta*) on the contrary, seemed to weary of gathering grasshoppers and frogs, and would spend much time in dressing their feathers; but while really undisturbed they never ceased to be suspicious, and the little flocks seemed to have a mutual understanding for their common safety, as every fifteen or twenty minutes one of their number would rise well up into the air and circle slowly about as if to see if the coast was clear. If at such a time any person was noticed approaching, or I purposely showed

myself too near them, the flying egret would give a loud, shrill call, and they would all rise up immediately and be gone for perhaps an hour. I frequently disturbed them, and so uniform was their action at such a time that I could exactly describe in advance to a friend what would be their movements when I alarmed them. So unvarying was their method of leaving and returning to the meadow that it seemed only explicable by considering it the predetermined routine, resulting from a consultation had among them when circumstances first led them to the spot in question.

As an instance, also, of these birds apparently "studying the situation," I daily noticed a change in their habits as the waters began to subside and restricted their range of submerged land. They seemed to know full well that an open meadow, six or eight inches under water, afforded no "cover" for their arch-enemy, man, but that he might crawl dangerously near in the long, tangled grass, now again exposed. The indication of this supposed train of thought on the part of the herons consisted in their increased suspicion, and the steadily increasing number of circular flights on the part of some of their number to see if any danger was near by.

It were useless to endeavor to give a detailed account of their many interesting movements, all of which were so indicative of genuine *thought*; but the whole series of observations, as I now recall them, and the perusal of my field-notes, more than ever fully convince me that these egrets, like all birds, depend upon, and are successful in life, I may say, more from their reasoning powers and their quality than they trust to or are dependent upon the operations of instinct.

THE HOUSE FLY.

BY A. S. PACKARD, JR.

A BRIEF history of the common house fly, which abounds to such an annoying extent in August, may not be out of season, especially as until within two or three years we were quite in the dark as to its mode of life and transformations. The *Mémoires* of the Swedish count, DeGeer, published just one hundred years ago, contain the first notice of the house fly, while a fuller account is given in an obscure book by Bouché, a German entomologist, published in 1834. Two years ago the writer made a special study of the mode of growth and life-history of the fly,¹ the leading points of which are here reproduced.

¹ On the Transformations of the Common House Fly. (Proceedings of the Boston Society of Natural History, xvi., 1874.) 8vo, pp. 14.

In the first place, is the common house fly of America the same as that of Europe? After a careful comparison of a number of individuals from Switzerland with many native examples, no difference could be found. How long it has been living in this country there are no data to show, and it may have been a passenger on the Mayflower, or buzzed in the cabin of Captain John Smith's vessel, or even performed its measured flight near the ceilings in the ancient town of Pemaquid.

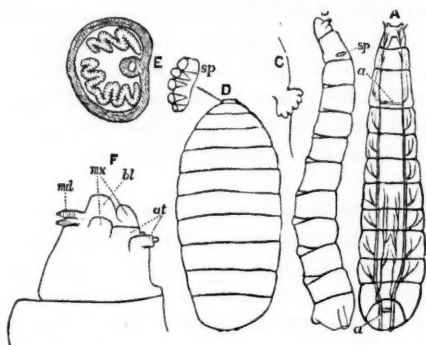
During the month of August the house fly is particularly abundant, and especially so in the neighborhood of stables. On placing a fly in a glass bottle, she laid, between six P. M., August 12th, and eight the next morning, one hundred and twenty eggs. They were deposited irregularly in stacks, lying loose in two piles at the bottom of the bottle. At eight in the morning of August 14th several were found hatched out and crawling about the bottom of the bottle. But a greater number of young were desired for purposes of study, and an abundance of food in which to rear them. A mass of freshly-dropped horse manure, still warm, was placed at an open window in the sun. This, with fresh masses added from time to time, attracted numbers of flies for three or four weeks succeeding, which laid eggs during that period, so that thousands of young in different stages of development were obtained.

Immediately after exposing the manure on the morning of August 12th, the flies appeared, and, penetrating down, often out of sight, deposited bunches of eggs in convenient crevices. The egg of the house fly is long, slender, cylindrical, and a little smaller at the anterior end than at the other. It is .04-.05 of an inch long and about one quarter as thick. The shell is so dense that the early embryonic phases could not be watched, but enough was seen to enable us to determine that the mode of growth in the egg is nearly the same as that of the flesh fly, as observed by Dr. Weismann.

The eggs thus laid were found to hatch twenty-four hours later. In confinement they required from five to ten hours more, and the maggots hatched in confinement were smaller than those reared from eggs deposited in warm manure. Certain worms reared also in too dry manure were nearly one half smaller than those bred in more favorable circumstances. For several days the worms living in this dry manure did not grow sensibly. Too direct warmth, but more especially the want of sufficient moisture, and consequently of available semi-liquid food, seemed to

cause them to become dwarfed. It is evident that heat and moisture are required for the normal development of the fly, as they are for nearly all insects.

The maggot molts twice, consequently there are three stages of development, and it becomes sensibly larger at each stage. After remaining in the first stage for one day it molts, and differs from the preceding stage only in being a little larger, and in the addition of the spiracle near the head (Figure 28, B, *sp*. C, the same enlarged.) After remaining in this stage from twenty-four to thirty-six hours it sheds its skin and enters upon the third stage, which lasts three or four days. Figure 28, A, B, represent the maggot; the body is long and slender, somewhat conical, the head and mouth-parts being rudimentary. The end of the body is truncated, and bears two short tubercles or spiracles. Figure 28, E, represents one of these circular breathing holes much enlarged, with three sinuous openings, the edges of which are



(FIG. 28.) EARLY STAGES OF THE HOUSE FLY.¹

armed with fine projections forming a rude sieve for the exclusion of dust and dirt. With these spiracles connect the two main tracheæ, communicating by two cross branches (*a*, *a*) and sending off numerous twigs. The young of the house fly differs chiefly from that of the flesh fly in being only one half as large, while the form of the openings in the spiracles at the end of the body is entirely different.

When about to transform into the pupa or chrysalis state the

¹ A, larva of *Musca domestica*, just hatched, showing the distribution of the two main tracheæ, and the anterior and posterior commissures (*a*, *a*), dorsal view. B, the larva in the second stage; *sp*, spiracle. C, spiracle enlarged. F, head of the same larva, enlarged; *bl*, labrum (?); *md*, mandibles; *mx*, maxillæ; *at*, antennæ. E, a terminal spiracle much enlarged. D, puparium; *sp*, spiracle. All the figures much enlarged.

body contracts into a barrel-shaped form, as seen in Figure 28, D, turns brown and hard, forming a case (puparium) within which the body of the larva transforms into that of the pupa. Weismann has made the discovery that in the larval flesh fly when about to transform into the pupa state, the head and thoracic segments die, and that the head and thorax of the pupa arise from minute disks attached to the smaller nerves or tracheæ in the body of the worm. This is paralleled by the metamorphosis of the "pluteus" into the adult starfish, and is a much more complete metamorphosis than even that of the caterpillar into the chrysalis of the butterfly.

Our house fly having as a maggot lived a life of squalor, immersed in its revolting food, with its new change of form, involving the death of one half its body and the origin of a new head and thorax, with legs and wings, eyes, feelers, and mouth-parts; after a short pupal sleep of from five to seven days pushes off one end of its pupa case, and appears winged, with legs where before there were no traces of feet, and is animated by new instincts and mental traits. It is difficult to realize how striking are the changes, physical and psychological, which the house fly undergoes in the transition from the maggot to the volant, cursorial being which puts a girdle, like Puck, around its little world, — the dining-room or parlor, — and like its mischievous prototype plays all sorts of antics, tasting the sugar, lapping the molasses, now tickling the nose of the sleeping housewife resting from her pre-prandial toils, or adjourning to the library and scraping with its spiny tongue the rich binding of the bookworm's treasures.

If in its winged condition it is one of the most disagreeable features of dog-days, and people wonder why flies were ever made at all, it should be remembered that flies have an infancy as maggots, and the loathsome life they then lead as scavengers cleanses and purifies the August air, and lowers the death-rate of our cities and towns. Thus, while stables and piggeries and filth are tolerated by city and town authorities, the young of the house fly and the flesh and blow fly, with their thousand allies, are doing something towards purifying the pestilential air, and averting the summer brood of cholera, dysentery, diphtheria, typhus and typhoid fever, which descend like harpies upon the devoted towns and cities. It may be regarded as an axiom that where flies most abound there filth, death-dealing and baneful, is most abundant, and filth-diseases such as we have named most do congregate.

As we have said, when the fly leaves its pupa-case it pushes away the front end of the case, which opens like a lid, by means of the distention of the membranous front of the head, which may be seen pushing out and in as the fly walks rapidly about. This bladder-like expansion is evidently distended with air and in connection with the air-tubes within the body, so that it may serve the temporary purpose of enabling the fly to disengage itself from its pupa-case. When free from its prison the fly walks or rather runs nervously about, as if laboring under a good deal of mental excitement, and quite dazed by the new world of light and life about it, for as a maggot it was blind, deaf, and dumb. Now its wings are soft, small, baggy, and half their final size. The fluid that fills them soon, however, dries up, the skin of the fly attains the colors of maturity and it soon flies off with a buzz suggestive of contentment and light-heartedness born of its mercurial temperament. That the fly not only throws off in its buzz songs of the affections, love ditties, but also may vary its notes accordingly as it is elevated or depressed in spirits concerning more trivial and less absorbing matters, we are assured by Sir John Lubbock, who says that the sounds of insects do not merely serve to bring the sexes together; they are not merely "love songs," but also serve, like any true language, to express the feelings.

The life of the house fly may, then, be summed up as follows: It lives one day in the egg state, from five days to a week as a maggot, from five to seven days in the pupa state, — in all, from ten to fourteen days in the month of August, — before the winged adult period. It is often asked how long-lived a fly is. Most of the flies which are born in August live for a month or six weeks, and die at the coming of frost, either of cold or from the attacks of fungoid plants. A few probably winter over and survive until midsummer, and thus maintain the existence of this useful species, to which civilized man owes more than he can readily estimate, and with which he can dispense only when the health of our cities and towns is looked after with far greater vigilance and intelligence than is perhaps likely to be the case for several centuries to come.

THE NATURAL HISTORY OF KERGUELEN ISLAND.

THE reports of Dr. J. H. Kidder, naturalist of the Transit-of-Venus Expedition, on the natural history of Desolation or Kerguelen Island are of interest from two reasons; first, the extreme paucity of life upon this barren rock; and second, the large number of naturalists who have been called upon to report upon the few specimens collected; as many as eight specialists in zoölogy and four in botany, as well as a mineralogist, contributing their aid, while the naturalists of the English Transit-of-Venus Expedition, particularly Rev. A. E. Eaton, assisted by several English and a German entomologist, have also published papers on the entomology of the island.

It will be remembered that the United States ship *Swatara*, with Dr. J. H. Kidder as naturalist, sailed from New York on the 8th of June, 1874, and landed, September 10th, two astronomers and Dr. Kidder, of the navy, with photographers and two of the crew. Some of the more interesting results we shall present to our readers, often using the language of the reporters. This island is situated southeast of Madagascar, in latitude 50°, longitude 65°, approximately. It is about ninety miles long by fifty in width, and is composed, as to its southern part at least, wholly of volcanic rock, showing no signs of stratification. The northern portion contains stratified rocks, deposits of coal of little value, and very ancient remains of silicified wood, indicating the former existence of trees of considerable size, and the submergence and subsequent upheaval of the land upon which they grew. The whalers say that a large glacier runs across the island, in a generally east and west direction, at about its centre. In the interior the land is mountainous, peaks with sharp volcanic outlines alternating with table-topped hills. Mount Ross, the highest peak (about five thousand feet), is always snow-covered and quite inaccessible. Near the sea, in December, the snow-line was found on Mount Crozier at about two thousand six hundred feet above the sea-level.

Kerguelen Island is a region of almost constant precipitation, only twenty-seven days out of four months being recorded as without snow or rain, and a still smaller number of nights. The thermometer ranged not far from the freezing-point, the daily average being a little below it in September and October, and a little above it in November and December. Whalers say that in midwinter there is no marked increase in the severity of

the weather. The lowest temperature recorded was 18° F., and the highest 64°. The island is also deservedly notorious for the violence of the gales which almost constantly prevail, and which often arise with a suddenness that makes it very dangerous to go about in small boats.

These climatic conditions have their natural effect upon the flora and fauna of the island, there being neither tree nor shrub, no plant, indeed, larger than the Kerguelen cabbage, while the very few species of phænogamous plants which do survive are such only as can thrive exposed to sudden and violent alternations of dryness and moisture, and to fierce gales of wind. As a natural consequence of these facts, there are no land-birds or mammals, strictly speaking, indigenous to Kerguelen Island, and but a single shore-bird (*Chionis minor*).

As might be expected, the insects were few in number, and some curious wingless forms were discovered, it being a characteristic of certain island species that they lose the power of flight and the wings themselves, wholly or in part. Several weevils occurred, most of which were incapable of flight, their wing-cases being soldered together. Two small moths with "very imperfect and abbreviated wings" were captured, though unfortunately afterwards lost. But the most interesting forms, evidently due to their singular physical surroundings, are three genera of wingless flies, which present several anomalies not heretofore observed. With the structure of flies, they possess many of the habits of beetles, such as that of counterfeiting death when in danger. One species (*Anatalanta aptera*), which feeds on carrion, has no vestige of either wings or balancers. A second kind, which feeds on the leaves of the Kerguelen cabbage (*Pringlea antiscorbutica*), is of considerable size, dark brown in color, with long legs, and showing considerable activity of movement, looking not unlike large ants. The wings are represented by small scale-like bodies. A third genus (*Amalopteryx maritima*) represents a further step in the progress of development, possessing both wings and balancers, but still unable to fly. Besides these forms, Mr. Eaton mentions a crane fly (a Tipulid) with imperfect or abortive wings. A small gnat was the only flying insect, except a curculio, observed on the island. Even the common house fly had not yet been naturalized.

Among other invertebrates is a species of sea-urchin (*Hemister*) which has been found by Mr. A. Agassiz to be viviparous, there being but one other genus (*Anochanus*) known to produce

young developing directly into the adult form without the marked metamorphosis usual in echinoderms.

In his able discussion of the structure and affinities of *Chionis minor*, the lesser sheath-bill, or "white paddy" of whalers, Dr. Coues has treated us to one of the most interesting ornithological essays that has appeared during the past few years. This bird is another instance, among the aberrant forms found in this island, of animals "whose structure gives no clew whatever to their habits, so aberrant has been the progress of their variation in the peculiar conditions under which they live." Thus the great southern skua has here adopted the habits of a land-hawk; and the lesser sheath-bill is "a connecting link, closing the narrow gap between the plovers and gulls of the present day. In our opinion, this group represents the survivors of an ancestral type from which both gulls and plovers have descended. And this opinion is strongly supported by the geographical isolation of its habitat, affording but few conditions favorable to variation."

In the practical matter of classification, it is evident that *Chionis* is not exactly referable to either of the two groups between which it stands. A consideration of its external characteristics, its digestive system, or its osteology, solely, would lead to very widely diverse conclusions. For we have presented in this bird a genus with the general appearance, gait, and flight of a pigeon; with the beak and voice of a crow; with the habits of a wader, yet dreading the water; and with the pugnacity and familiarity with man of a rasorial bird. With the last group its digestive system would certainly place it, to say nothing of the long after-shafts of the feathers; and osteological comparison establishes its position definitely between the gulls and the plovers, but rather nearer to the former.

The only land mammal found on the island is the common mouse (*Mus musculus*), which abounds everywhere, and was doubtless imported by one of the early sealers. It builds its nest in holes in sand-banks, lining it with dried grass-stems or bits of oakum, and appears to feed mostly on grass-seed.

The sea-elephant is the most interesting marine mammal. It begins to "haul up" on the beaches of its breeding-places about October 10th, and remains ashore until well into the month of January. The old bulls, which alone are provided with a proboscis, take charge, each, of a large number of females, guarding them from the approach of other bulls, and (so the sealers assert) prevent them from returning to the sea before the young are old

enough to do so with safety. During the breeding season the bulls are very pugnacious, fighting fiercely with each other, and even attacking the sealers themselves. Although seemingly so unwieldy, they are described as getting over the beaches with surprising speed, advancing both flippers at a time and using them like crutches. The beaches of Royal Sound are fringed by innumerable wallows — cradle-shaped pits — in which the animals lie during the breeding-season, recalling the buffalo-wallows of our western prairies.

The increasing scarcity of the sea-elephant and the consequent uncertainty in hunting it, together with the diminished demand for the oil since the introduction of coal-oil into general use, have caused a great falling-off in the business of elephant-hunting. The Crozet Islands, for example, have not been "worked" for five years, and at Kerguelen there was only one small schooner engaged in this pursuit, two others making Three Island Harbor their head-quarters, but spending the "season" at Heard's Island, three hundred miles to the southward. It may, therefore, be reasonably hoped that these singular animals, but lately far on their way toward extinction, will have an opportunity to increase again in numbers, and that the sealers may learn from past experience to carry on their hunting operations with more judgment, sparing breeding females and very young cubs. When the Monongahela visited the Crozet Islands on December 1st, they found the sea-elephants very numerous, although left undisturbed for only five seasons.

Besides the sea-elephant, the sea-leopard (*Ogmorhinus leptonyx*) often visits the island, as do several species of seal. The sea-leopard is also sought for its oil, but is less valuable, being a much more active animal, and therefore less heavily loaded with blubber. The king-penguin is said to be its favorite food, a statement which speaks well for the sea-leopard's activity in the water, the penguin swimming rapidly enough of course to catch the fish upon which it feeds. The leopard is described as pursuing and overtaking the penguin under water, rising to the surface and tossing it into the air, so as to catch it more securely, cross-wise in its jaws.

RECENT LITERATURE.

FRITSCH'S BIRDS OF EUROPE.¹ — This work is by an accomplished zoölogist, the author of an elaborate memoir on the cephalopods of the cretaceous formation of Bohemia, and more recently of a work on the laws of migrations of the birds of Europe, containing "an immense amount of data, which have been worked up most satisfactorily," as stated by Mr. R. B. Sharpe in the Zoölogical Record for 1874. The present work briefly describes the orders, families, genera, and species of European birds, with their most important synonyms and diagnoses, and notes on breeding habits and distribution. These descriptions, conjoined with the chromo-lithograph of each species, — executed in most cases nearly as well as the figures in the United States government reports, but nearly all reduced below the natural size, — will enable one to readily identify any European bird. The classification is perhaps antiquated, beginning with the birds of prey, but the treatment of the subject is that of a skilled ornithologist. It is evidently inferior to Dr. Coues's admirable Key to North American Birds, though we are not sure but that a compact work of this nature, accompanied by an atlas of chromo-lithographic plates and published for fifty dollars, would not be welcomed by amateur ornithologists, though Coues's Key on the one hand, and Baird, Brewer, and Ridgway's magnificent work on the other, leave almost nothing to be desired by the American student who lives in a town or city having in its library Audubon's Birds of America and the government and state reports containing the ornithology of the Western and Pacific States.

Dr. Fritsch's work is highly spoken of by Dr. Hartlaub, Von Homeyer, and a reviewer in Cabanis' *Journal für Ornithologie*, and would form a valuable work of reference in any library.

RILEY'S EIGHTH REPORT ON THE NOXIOUS INSECTS OF MISSOURI.² — The Colorado potato beetle, the canker worm, the army worm, the Rocky Mountain locust, and the grape Phylloxera receive much attention in this report, and fresh information is given regarding their habits, devastations, and the means of combating them. It is shown by the experiments of Professor Kedzie that Paris green does not poison the soil or become absorbed by the plants, and the reporter insists that, used with caution, it is the best remedy for the ravages of the *Doryphora*. He adopts and extends Walsh's view that this beetle gradually spread to the Atlantic from the "mountain region of Colorado," and in another place (page 10) that "the native home of the species is the more fertile coun-

¹ *Naturgeschichte der Vögel Europa's*. Von DR. ANTON FRITSCH. Prag. 1853-70. Text 8vo, pp. 506, with atlas of 61 plates, folio. S. E. Cassino, Naturalists' Agency, Salem, Mass. \$40.

² *Eighth Annual Report on the Noxious, Beneficial, and other Insects of the State of Missouri*. By C. V. RILEY. 8vo. 1876.

try east of the [Rocky] mountains, extending from the Black Hills to Mexico, where it becomes scarce, and is represented by *Doryphora undecimlineata* and *D. melanothorax*." With this latter view we entirely coincide, but Walsh's idea of its being a mountain-insect is erroneous, as it does not injure the potato fields in Colorado above an altitude of about seven thousand feet, is confined mostly to the plains, and is a subtropical insect, with its allies living on the plains of Mexico, Central America, and New Grenada. He opposes the view, and we think with good reason, that the beetle is poisonous. The reporter shows that the two species of canker worm differ so much in the egg, larva, pupa, and adult state as to belong to different genera. While we should hardly be inclined to separate the two species generically, entomologists are greatly indebted to Dr. Riley for the mass of new facts regarding their specific distinctions which he has presented with pen and pencil.

The chapter on the locust affords interesting reading, and contains valuable suggestions as to the best means of withstanding its attacks, for which government aid is invoked. New facts regarding the grape Phylloxera and army worm, and an essay on the yucca borer, also aid in rendering the report one of the most interesting and practically valuable that has yet been issued.

THE ZOOLOGICAL RECORD FOR 1874.¹—On opening this volume, which has just been received, our attention is drawn to the increasing amount of work done by American zoölogists, which bears a fair proportion to the amount of labor performed by other nations. The recorder of literature on mammalia says that, "as in 1873, special notice is due to the labors of Leidy, Marsh, and Cope, among the remains of the mammals of the American tertiary periods." In the portion on birds the recorders state that "the striking discoveries for the year 1874 are limited in number; but some remarkable books have nevertheless been produced during its course, the chief of which must be reckoned the great works on North American birds by Messrs. Baird, Brewer, and Ridgway, and Coues." The researches of Professor Morse on the Brachiopods, and of Mr. A. Agassiz on the Echini and the embryology of the Ctenophora, are noticed at greater or less length. We repeat what we have before said, that this Record is indispensable to the American zoölogist in particular, as so many live away from scientific libraries, while the working naturalist in scientific centres needs one at hand at all times. We shall be glad when the time comes that fewer new species will have to be recorded, and more attention given by zoölogists to the natural history of animals, and consequently a fuller record of how animals act, think, and are mutually related may be presented in such a record of zoölogical discovery as the present. Systematic zoölogy is largely dictionary-work, and preparatory to true biological studies.

¹ *The Zoölogical Record for 1874*; being Volume Eleventh of the Record of Zoölogical Literature. Edited by E. C. RYB. London: John Van Voorst. 1876. 8vo, pp. 557.

RECENT BOOKS AND PAMPHLETS. — A Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country. By F. B. Meek. (U. S. Geological Survey of the Territories, F. V. Hayden in charge.) Washington, D. C. 1876. 4to, pp. 629. 45 plates.

A Monograph of the Geometrid Moths or Phalaenidæ of the United States. By A. S. Packard, Jr. (U. S. Geological Survey of the Territories, F. V. Hayden in charge.) Washington, D. C. 1876. 8vo, pp. 607. With 13 plates.

On the Geology of Portions of our Western Territory visited in the Years 1871, 1872, and 1873. By G. K. Gilbert. (Extracted from vol. iii. of the U. S. Engineers' Reports of Explorations and Surveys west of the 100th Meridian, Lieut. G. M. Wheeler in charge.) Washington. 1876. 4to, pp. 20-187, 506-681.

Report on the Geology of Portions of our Western Territory visited in the Years 1872 and 1873. By Edwin E. Howell. (Extracted from vol. iii. of the U. S. Engineers' Reports, etc.) Washington. 1876. 4to, pp. 231-301.

Birds of Southwestern Mexico, collected by F. E. Sumichrast. Prepared by G. N. Lawrence. (Bulletin of the U. S. National Museum, No. 4.) Washington, D. C. 1876. 8vo, pp. 56.

Classification of the Collection to illustrate the Animal Resources of the United States, etc. By G. Brown Goode. (Bulletin of the U. S. National Museum, No. 6.) Washington, D. C. 8vo, pp. 126.

Zur Naturgeschichte der Daphniden. Von Dr. A. Weismann. I. Ueber die Bildung von winteriern bei *Leptodora hyalina*. Leipzig. 1876. 8vo, pp. 64. 3 plates.

Report on the Geology and Gold Fields of Otago. By F. W. Hutton and G. H. F. Ulrich, etc. Dunedin. 1875. 8vo, pp. 244.

On a New Crinoid from the Cretaceous Formation of the West. By George B. Grinnell. (From the American Journal of Science and Arts, xii. July, 1876.) 8vo, pp. 3.

Contributions to the Flora of Iowa; a Catalogue of the Phænogamous Plants. By J. C. Arthur. Charles City. 1876. 8vo, pp. 43.

Taxidermy without a Teacher. By Walter P. Manton. Illustrated. South Framingham, Mass. 1876. 12mo, pp. 41. 50 cents.

Annual Report of the Entomological Society of Ontario, etc. Toronto. 1876. 8vo, pp. 54.

The Mineral Wealth, Climate and Rainfall, and Natural Resources of the Black Hills of Dakota. By W. P. Jenney. Washington, D. C. 1876. 8vo, pp. 71.

GENERAL NOTES.

BOTANY.¹

NOTES ON ACNIDA. — Dr. John Mitchell, one of the very earliest of our botanists, in a zoological and botanical memoir which he sent from Virginia in 1741 to Sir Hans Sloane, in London, and which Sloane had published soon after in *Acta Acad. Nat. Cur.*, at Nuremberg, characterized the genus *Acnide*. Linnæus, in adopting it, changed the orthography to *Acnida*, for no reason which would now be thought sufficient; but the difference is unimportant. *Acnida cannabina* was the sole Linnæan species.

In Michaux's Flora a second species was characterized, *A. rusocarpa*, with obtuse-angled rugose fruit. This specific name was somewhat puzzling. Willdenow took it for a misprint of *ruscocarpa*; but Sprengel

¹ Conducted by PROF. G. L. GOODALE.

saw that it was meant to refer to the rugose fruit, and therefore should have been written *rhyssocarpa*.

The essential characters of the genus are: flowers diœcious; the female achlamydeous.

The true *Acnida* are subarctic and have a pretty large and indehiscent utricle, which is somewhat fleshy when fresh. Our botanists on the whole have failed to make out more than one species.

Moquin-Tandon, in De Candolle's *Prodromus*, in 1849, added a section, *Montelia*, with a more membranaceous, utriculate, and smaller fruit, under which he placed two species, *A. tuberculata*, a new one, and *A. ruscocarpa*, which he took for Michaux's of that name; but the plant he describes is not the one figured in Michaux's *Flora*, and I suppose is not distinct from Moquin's own *A. tuberculata*. This belongs mainly to the banks of rivers and lakes.

When I published the second edition of my *Manual of the Botany of the Northern United States*, I had in cultivation, from Fendler's seeds, the *Amarantus tamariscinus* of Nuttall, which I saw had the characters of *Acnida*, sect. *Montelia* of Moquin-Tandon, except that the utricle was circumscissile in the manner of a true *Amarantus*. Whereupon, having adopted *Euxolus*, I followed up Moquin's hint, and set up *Montelia* as a genus, upon what I took to be one polymorphous species; having, by a sad oversight, confounded Moquin's *Montelia*, which has a small and indehiscent utricle, with my *M. tamariscina*, the utricle of which dehisces transversely, and which likewise has far more slender fertile inflorescence.

While correcting this gross mistake, I wish also to direct the attention of our botanists this summer to the coast species of *Acnida*, and to request that specimens be prepared, and also critically examined when fresh, with the view of soon determining whether I am justified in my belief that we have three genuine species on the Atlantic coast, or within reach of tidal water. If my present opinion is well founded as to the species, and as to the extent of the genus, the arrangement should be somewhat as follows:—

ACNIDA (*Acnide* Mitchell) Linn.

(1.) EUACNIDE. Utricle somewhat fleshy, indehiscent, large, *i. e.*, one and a half to two lines long.

A. RHYSSOCARPA, alias RUSOCARPA Michx. Fertile inflorescence very naked; the bracts not half the length of the fleshy utricle, the angles of which are not rarely rugose-tuberculated; stigmas comparatively short and slender-subulate. Salt marshes, New England to Georgia.

A. CANNABINA L. Fertile inflorescence slender or sometimes glomerate; utricle thinner and smaller, with acute and smooth angles, much exceeding the bracts; stigmas very long and filiform, almost plumosely hairy. Salt marshes and river-banks even beyond brackish water, New England to Georgia, West Indies (?), etc.

A. AUSTRALIS, n. sp. (*A. cannabina* Chapman, S. Flora.) Panicked spikes of the fertile inflorescence dense, linear-cylindrical; utricle smooth, thin, hardly at all fleshy, acute-angled, little if at all exceeding the imbricated bracts; stigmas setaceous, rather short. Florida, at Apalachicola, Dr. Chapman; Biscayan Bay, Dr. Palmer, coll. no. 462.

(2.) *MONTELIA* Moquin-Tandon. Utricle thin and small (half to two thirds of a line long), punctate-rugose or roughish, indehiscent), equaled or exceeded by the cuspidate-tipped bracts; stigmas slender, filiform, almost plumosely hairy.

A. TUBERCULATA Moquin-Tandon, in DC. Prodr. *A. rusocarpa* Moquin-Tandon, l. c., not of Michx. *A. cannabina* var. *concatenata* Moquin-Tandon, l. c. *Amarantus Miamensis* Riddell, synopsis. *Montelia tamariscina* Gray, Man., Bot. ed. 2, 370, and ed. 5, 413, partly, especially the var. *concatenata*. River-banks, shores, etc., in the interior. Lake Champlain to Iowa and Texas. Sometimes erect, and from one to four feet high, sometimes spreading or prostrate in sandy or gravelly soil.

(3.) *PYXIDI-MONTELIA*. Utricle thin and small, shorter than the cuspidate-tipped bracts, circumsessile in the manner of true *Amarantus*; fertile inflorescence in slender virgate paniculate spikes, less glomerate than in the preceding; stigmas similar or shorter.

A. TAMARISCINA. *Amarantus tamariscina* Nutt., in Trans. Am. Phil. Soc., n. ser., v. 165. *Montelia tamariscina* Gray, l. c., in part. Arkansas to Texas and New Mexico.

Our botanists along and near the seaboard are particularly requested to examine the species they meet with, and to send good fruiting specimens to the writer. The distinctions between *A. cannabina* and *A. rhysocarpa* should be especially looked after. The fruit of the former is hardly to be found in any of our larger herbaria. Florida specimens of any *Acnida* are much desired. So also are fertile specimens of any from Arkansas and Texas, especially of *A. tamariscina*. Nuttall's specimens of this are not even in flower, so that he was unaware that the plant was dioecious and the fertile flowers achlamydeous. Although the plant is common in Texas, ripe fruit is little known. — ASA GRAY.

LARGE ELM. — In the second and admirably illustrated edition of Mr. Emerson's classical report on the trees and shrubs of Massachusetts, most of the notable elms in the State are enumerated, and measurements given. But one of the noblest, though by no means the largest, of them, to which the writer was recently introduced, is not upon the record. It is in Boxford, Essex County, not far from the eastern border of Andover, a stately tree, with a girth of nineteen feet at the smallest part of the trunk below the limbs, and a full top in good condition, except that a few of the uppermost limbs are perishing in the manner of the species. — ASA GRAY.

CALLUNA VULGARIS, THE LING OR HEATHER, REDISCOVERED IN MASSACHUSETTS. — The now well-known patch of *Calluna* in Tewksbury,

which was discovered by Mr. Jackson Dawson nine or ten years ago, was then the only one known in the United States or, indeed, on the continent. Up to this time the only contradiction to the current aphorism, "There are no heaths in America," came from Newfoundland, where *Calluna* was known to occur, although few botanists had ever seen specimens. It required some hardihood, as well as a clear conception of the causes which have ruled over the actual distribution of our species in former times, to pronounce that this Tewksbury patch of heath was indigenous. The discoveries, soon afterwards, in Nova Scotia and Cape Breton still left a wide hiatus. This was partially bridged over by the detection by Mr. Pickard, a Scotch gardener, of a similar very restricted station in Maine, on Cape Elizabeth, near Portland. We have now the satisfaction of recording a second station in Massachusetts, not far from the former one. Mr. James Mitchell, of Andover, is the present discoverer, and the station is in the western part of Andover, half a mile northeast of Haggett's Pond, and five miles north of the Tewksbury station. Mr. Mitchell accidentally met with this patch last summer, when berrying, and, being a Scotchman, recognized it, took home a sprig of it, and at a subsequent visit grubbed up one or two small plants, which a neighbor still has in cultivation. A fresh branch taken by him from the wild plants this summer is now before me. It proves to be of the green and smoothish variety of *Calluna*, precisely like the Tewksbury plant. Small as the new patch is said to be, "it will serve" to confirm the opinion long ago expressed; for a second station greatly diminishes the very small chance of its having been casually or in any way introduced through human agency. It should also be noted that this station, as I am informed by the Rev. Mr. Wright, is near by an extensive glacial moraine which traverses that district, and which he has traced for a great distance northward. — ASA GRAY.

HETEROMORPHISM IN EPIGÆA. — The May-flower, being more largely gathered and brought under our notice than any other wild blossom — at least in the Atlantic States — should be well known in all the details of structure. But it hardly is so. The structure of its stigma was first well described in the fifth edition of my Manual of the Botany of the Northern United States, and the likeness to *Pyrola* suggested. I suppose that this likeness is really one of relationship, but not of a near degree, as most other points of similarity are wanting. From the difference in the stigmas of different flowers, I was disposed to think that the five lobes lengthened and protruded with age, in the manner of *Pyrola*; but this does not prove to be the case. In all cases, however, the apex of the style is as it were hollowed out or extended into a ring, with a five-crenate border, to the inner face of which the five stigmas are adnate, each before one of the small teeth or lobes, and extending sometimes slightly beyond it, but remaining short and erect, sometimes much beyond and radiately expanded.

In Michaux's *Flora* is the note "*Flores omnes in nonnullis individuis abortivi*," and botanists are generally aware that fruit is seldom met with. The flowers have been said to be unisexual (dioecious); but all appear to have well formed ovary and ovules, although some individuals were known to want the stamens. Professor Goodale, knowing a station in Maine in which *Epigæa* year after year sets fruit, kindly procured from thence a large number of fresh specimens; and these I have now examined in regard to stamens and pistil. They show the following heteromorphous condition of things.

(1.) About ten per cent. of the specimens have a style considerably longer than the stamens, raising the stigmas a little out of the throat of the corolla, in which the anthers are included: the stigmas are cylindraceous, radiate like the spokes of a wheel, half a line in length, therefore strongly projecting, moist and glutinous, and evidently in good condition for fertilization. The anthers in these flowers are slender, commonly withering without dehiscence, and containing few; yet perhaps well-formed, pollen-grains. The fruiting specimens gathered at the same station in former years all evidently belong to this form, as the persistent style and long stigmas show. One or two specimens of this form manifest a disposition to convert their anthers into petals; but this is occasionally seen in other forms.

(2.) A smaller number of specimens show the stigmas of the preceding on a shorter style, sometimes so short as to place the radiating stigmas as low as the middle of the tube of the corolla, sometimes bringing it nearly up to the throat. In one instance a short-styled flower was detected in a cluster of flowers otherwise of the character of No. 1. These short-styled blossoms, instead of having more conspicuous or higher anthers than in the long-styled, bear them either at the same proportional height and in the same condition, or bear mere rudiments of anthers, or not rarely none at all, and even the filaments are smaller, abortive, or occasionally altogether wanting. This sometimes happens in No. 1 also.

(3.) The larger number of flowers, perhaps three-fourths of the specimens under examination, have the long style of No. 1, an ovary equally well-formed and ovuliferous, but either rather smaller or not going on to grow; but the stigmas are short, only slightly projecting beyond the lobes of the cup to which they adhere, in all stages erect, and comparatively smooth and dry. Their tips, however, appear somewhat papillose under a strong lens, and grains of pollen placed thereon incline slightly to adhere, yet not so much as upon the surface of the style far below, which gets well covered with pollen from the contiguous anthers. The difference between these stigmas and those of the foregoing forms is striking and constant, no gradations between them having been detected. The anthers abound with pollen, and are dehiscent at or a little before the opening of the corolla.

(4.) A considerable number of such flowers have a shorter style, so that the stigma stands as low as the base of the five longer anthers, in one or two even lower than all the anthers; otherwise all is as in No. 3, of which this seems to be a mere variation. And here also, although not very definitely, there is a tendency to having lower instead of higher anthers in connection with the short style.

The flowers of *Epigæa* may therefore be classified into two kinds, each with two modifications; the two main kinds characterized by the nature and perfection of the stigma, along with more or less abortion of the stamens; their modifications, by the length of the style. The first is leading to dioecism, the second points to dimorphism. I am not aware that either unisexual or dimorphous flowers are otherwise known in the *Ericaceæ*. Dimorphism (as exemplified in primroses, *Houstonia*, and *Mitchella*) may be regarded as the more perfect arrangement on the score of economy, as it secures cross-fertilization along with fertility of all the flowers. It would seem as if this had been attempted in *Epigæa*, but that the stamens did not respond with the requisite correlation to the long and short styles; and the same may be said of certain flowers in one or two other families. Of dichogamy, the other equally economical method, I find no indication in *Epigæa* blossoms. But they appear to be now falling back upon the remaining, less economical mode of securing the end, namely, by unisexual blossoms.

It would be interesting to know whether the small-stigma forms of *Epigæa* are ever fruitful, or fully so. It might not be difficult to ascertain the kind of flower in any case which has matured fruit; for the style and stigmas persist until the capsule is well formed in the fruit thus far known.

The aestivation of the corolla is that of the tribe, imbricated, but with a strong tendency to convolute; more commonly there is only one exterior and one interior lobe.

In reproducing from the *American Journal* this account in the *NATURALIST*, I have a special object, that of having search made this summer for fruiting specimens of all sorts. I should be glad to receive the fruit from various parts of the country, in order to ascertain, if possible, whether the short-stigma blossoms ever set seed, — as it seems likely they may, — and whether the seeds or capsules show any differences. In collecting and preserving fruiting specimens, care should be taken not to detach the style. — ASA GRAY.

BOTANICAL PAPERS IN RECENT PERIODICALS. — *Comptes rendus*, April 24th. Boussingault, On the Growth of Plants which have no Chlorophyll. Frémy and Dehérain, Researches in regard to the Sugar Beet. May 8th. Pasteur, Notes respecting Fermentation.

Flora, No. 14. Dr. Velten, The relation of Temperature to the Movement of Protoplasma. A. de Krempelhuber, Brazilian Lichens. No. 15. Dr. Chr. Luerssen, Notice of Wawra's Vascular Cryptogams. W. Nylander, New European Lichens.

Botanische Zeitung, No. 19. W. Velten, On Electricity in Plants. No. 20. Ascheron, Phytographic notices. No. 21. Ascheron, On Malaguetta Pepper. No. 22. Areschoug, On certain Rubi. No. 23. De Borbás, Conspectus of doubtful species of *Dianthus*. No. 24. Philipi, On Sandal-Wood of Juan Fernandez. On *Primula pistiifolia*, Gris. No. 25. Reuther, On the development of the flower. No. 26. Continuation of the last. In the above numbers there are several interesting reports of scientific meetings which will be hereafter noticed.

ZOÖLOGY.

A TRUE "SNAKE STORY."—The article in the March number on "A Snake-Eating Snake" recalls to memory an incident which occurred to me last year, showing that such reptiles are found nearer home than Costa Rica. In walking through a cañon about two miles east of Oakland, Cal., one spring morning, I met with a fine specimen of the California milk-snake (*Lampropeltis Boylii*, figured in Pacific Railroad Report as *Coronella balteata*, x. 14, Plate V). Having disabled it by a blow across the back, I wrapped it in paper and put it in a bag, intending, when I sat down to rest, to skin it, and to examine the contents of its much-distended stomach. About noon I opened the paper and was not a little startled to find that my milk-snake, so strongly characterized by alternating belts of black and white, was apparently transformed into a garter-snake of about the same size, with longitudinal stripes.

The first impression was that I had got hold of one of the deceiving tribes of the "old serpent" himself, but recalling the scientific coolness with which Cuvier is said to have confounded him when under the disguise of horns and hoofs, I ventured to look closer, and found that the garter-snake must have been swallowed whole by the milk-snake, which, on recovering from the stunning blow I gave, had disgorged its prey, and then succeeded in crawling through a hole in the bag. All this would not have seemed so strange if the two snakes had not been so nearly of a size that I did not at first notice any difference. As I recollect, the garter-snake was over two feet long, but being damaged, and a common species, I did not preserve it. I had not captured any of the kind recently, nor any other snake except the milk-snake. — J. G. COOPER, M. D.

"THE BANK SWALLOW" AGAIN. — Regarding the instance in which Dr. Haymond observed a "bank swallow" carry building material into an auger hole, as communicated to the June number of the *NATURALIST* by Dr. Coues, it may be fairly questioned whether the species was not the rough-winged swallow (*Stelgioöpteryx serripennis*), which is much more common in many parts of the country, particularly in the Mississippi Valley, than the other species. The habits and appearance of the two birds are so similar that they are very often confounded, even by good and experienced observers; besides, it is well known that the rough-wing

often does build about bridges and in such situations as that described by Dr. Haymond. — R. RIDGEWAY.

THE GREEN SNAKE IN NEW MEXICO. — It may be interesting to mention an increase of geographical range for the common green snake (*Cyclophis vernalis*). It was found in 1874 at Abiquin, New Mexico, in the valley of the Chama, by Dr. O. Löew, and in 1875 by Lieut. W. L. Carpenter, U. S. A., in Moreno Valley, Northern New Mexico, and again at the head of Ponil Creek, Northern New Mexico. Lieutenant Carpenter also states that the species is by no means uncommon in Southern Colorado. — H. C. YARROW.

ANTHROPOLOGY.

NOTES ON THE STONE IMPLEMENTS FROM ARKANSAS, AT THE PHILADELPHIA EXHIBITION. — In the building erected by the State of Arkansas for the purpose of exhibiting the various resources of that commonwealth is a small but very beautiful series of stone implements, all of which, as I was there informed, were taken from various mounds in Garland, Montgomery, and Saline counties. While the various common forms of implements are all represented by excellent specimens, there is a noticeable preponderance of certain patterns which in other localities are less abundant than allied forms. For instance, the polished celts, of sizes suggesting the ax, rather than a skinning knife, are numerous represented, while but few specimens of the more common grooved ax are in the collection. Whether this preponderance of large celts, as compared with grooved axes, obtains throughout the territory from which these specimens were brought, I could not learn. Certainly, in the Eastern and Middle States the grooved axes are more abundant than celts of the same average size. The spear and arrow points are represented by a series which for beauty of material — they are all chipped from novaculite — and delicacy of workmanship far surpass any similar forms that I have seen. This perfection of the art of flint-chipping is alike in the spear-heads, six and eight inches in length, and the smallest of the arrow-points, scarcely more than half an inch long. The pestles are all cylindrical, and not with a flaring end, as is common to this form of implement in many localities. Of rude implements but few specimens are shown, and none with that weathering of the surface and roughness of chipping characteristic of the rude implements found in New Jersey, more especially in the valley of the Delaware.

Two specimens of a stone implement are shown which are believed to have been used in the cultivation of Indian corn. They certainly bear considerable resemblance to an ordinary plowshare, and doubtless could be used, if attached to a wooden handle, as a rude hand-plow, in light, sandy soils. The specimens bear marks of use upon them, and being found, as I am informed, in mounds, associated with undoubted relics, must be considered to be such, even though the conjecture as to their

being plows be far from the truth. The pottery is represented by several fragments of large jugs or vases, which are very elaborately ornamented; more so, I believe, than is usually the case, even with the earthenware of the mound-builders.

There is one roughly fashioned specimen of perforated stone, which would at first glance be looked upon as a poorly made chungkè stone. I call attention particularly to it because in the exhibit from the Cape of Good Hope there is a fac-simile of this Arkansas specimen, which, the commissioner from the Cape says, is a root-digger; a wooden handle is inserted in the perforation of the stone, and it is then used to drag away the earth from long tubers, in order that they may be gathered without fracture. May it not be that some of these rude chungkè stones, especially those that are small and not polished, were used thus, and not for playing the game which has given a name to perhaps more than two forms of stone implements? — CHAS. C. ABBOTT, M. D.

STONE IMPLEMENTS FROM OHIO, AT THE PHILADELPHIA EXHIBITION. — The collections here brought together, and very conveniently arranged, occupy fourteen large cases, and give an excellent idea of the proficiency in flint-chipping attained by the aboriginal peoples of that State. Of the arrangement of the great number of specimens here exhibited, but one word other than of praise need be said. Would it not have been better to separate the surface-found or Indian relics from such as are referable to the mound-builders; or is this indeed impracticable?

Without further comment on the exhibit itself, which is so highly creditable to those having it in charge, I desire to make some comparative notes upon it, with reference to the allied and identical forms of stone implements found in New Jersey.

The display of arrow and spear heads is very complete. In comparison with those from New Jersey, the large number of specimens with serrated edges in the Ohio collection is very noticeable. They are not at all abundant in New Jersey; and the same may be remarked of the twisted or "rifle" arrow-points, of which there are a number on exhibition. Every type, both American and European, is well represented, and the gradation into spear and javelin heads is well shown. Of these larger forms, many are truly magnificent specimens of flint work, and compare well with the best specimens of Danish implements of the same pattern.

The exhibit of grooved stone axes, like that of the arrow-heads, is very large. They vary but little in pattern, but considerably in size, the largest specimen weighing sixteen and a half pounds. These axes are in all respects identical with those from New Jersey, the one difference in the series being a comparative absence of those not having the groove extending entirely around the specimen. The majority of stone axes found in New Jersey certainly are of this pattern.

The pestles exhibited are mostly short and flaring at the grinding ends, a form very rarely occurring in New Jersey.¹ Of drills, rimmers, or borers, whether for drilling in stone or merely perforating leather, the exhibit is very large and the specimens remarkably perfect, considering the delicate shape of the implement. While they do not differ from those found in New Jersey, they are of greater excellence of workmanship, as compared with those now found here; but it is not improbable that the longer time that the eastern specimens have been exposed to the rough usage of the plow, and their being found in stony fields usually, has caused the destruction of all but the stronger and ruder specimens in New Jersey. The same remarks are applicable to the scrapers in the Ohio collection. They do not differ from those found along the Atlantic coast. The series of pipes exhibited is a very attractive feature of the collection; and here, perhaps more than elsewhere, the commingling of Indian and mound-builders' relics is noticeable. Considering all that have the outlines of animals as those of the latter people, the other specimens show a much greater variety of shapes than the writer has as yet found in New Jersey; space will not permit us to give further details as to the various forms of stone implements exhibited, such as gorgets, charms, and animal-carvings. These differ in no way from similar ones found in New Jersey, if we consider the outlines of animals graven on stone as the work of the mound-builders.² Taken as a whole, the collection shows a somewhat greater proficiency in the art of working in stone, *with stone*, than would be demonstrated by a like series from New Jersey, and would point to a lower condition of the Atlantic coast tribes; but the difference is more apparent than real; for if eastern specimens of jasper, chalcedony, and quartz implements only are exhibited, we shall find about equal skill in flint-chipping; and it is only implements made from such minerals that are shown in the Ohio collection. It must be borne in mind, too, that a proportion, perhaps very large, of these beautiful spear and arrow points are the production of mound-builders. It is therefore an unwarrantable conclusion that the red Indians lost something of their skill in fabricating stone implements, as they wandered eastward. Leaving out of mind the mound-builder, is there anything to show that the Indian was ever more advanced in culture than he was when first known to the European? On the other hand, is there not much to indicate that he was at one time far less so?

— CHAS. C. ABBOTT, M. D.

ANTHROPOLOGICAL NEWS. — The Ninth Annual Report of the Trustees of the Peabody Museum of American Archaeology and Ethnology is just issued from the Cambridge press. In addition to the usual informa-

¹ A magnificent specimen of this form is exhibited in one of the cases of the Rhode Island display, which, though small, is very interesting.

² It is very probable that some three or four specimens of well-drawn animals are not genuine; as certainly two or three of the ornamental axes of striped Silurian slate are very modern.

tion concerning the government and finances of the museum, we have the report of the curator, Mr. F. W. Putnam, upon the condition of the specimens and the additions. The most valuable gifts are from Mr. Alexander Agassiz and Mr. Paul Schumaker. Other contributors of objects and books are mentioned. The curator acknowledges the gratuitous services of Messrs. Lucien Carr and Ernest Jackson. The noticeable feature of the report is the photographs of Mr. Peabody and Dr. Jeffries Wyman, and the index to all the Reports to date. All of them are to be bound into a Centennial volume, in compliance with a call made "upon the public institutions and societies in the United States to furnish some account of their rise and progress," etc.

In *Bulletin de la Société de Géographie*, April, 1876, pages 401-438, V. Derrécagaix gives an extended notice of the Basques, which race the ethnologists of Europe regard as a connecting link between the prehistoric races and the earliest historic tribes of France and Spain.

In the *Comptes rendus de l'Académie des Sciences de l'Institut de Bologne*, J. Capellini publishes an article upon pliocene man in Tuscany. After an extended argument to identify the glacial epoch with the pliocene in Tuscany, the learned author finds the evidence of man's existence in the occurrence of notches and gashes in dorsal apophyses of the *Balenotus*, a species of cetacean, that he supposes to have been made by human agency, and with stone implements. P. Cazalis de Fondouce replies, in *Matériaux*, that while there seems to be evidence of the existence of a tertiary man, M. Capellini's proof is not conclusive, for the incisions in the *Halitherium* of Pouance are known to have been made by the *Carcharodon megalodon*, the dents and gashes in the bones found in the marl beds of Liognac were made by the *Surgus serratus*, and those in the bones from Saint-Prest by the *Canodontes Boinsvilletti*.

Number 5 of *Matériaux* comes to us with an interesting array of matter. The following are the principal articles: History of Quaternary Mammals in France, by J. Gaudry. The Discovery of a Human Station of the Neolithic Period, near Belfort, by Charles Grad. Flint Arrow-Points from the Gironde in the Collection of M. L. Lalanne, by E. Cartailhac. Studies upon the Primitive Races of Russia — The Meriens, by Count Ouvaroff. Celtic Tribes known to the Greeks anteriorly to the Third Century B. C., by M. Mazard. Upon a Station of the Stone Age at Basseville, near Clamency (Nièvre), by Darlet.

At the meeting of the ethnological section of the Russian Geographical Society, May 13th, M. J. Venieckoff read a report of the special commission charged to examine into the proposal to publish in an abridged form all the information that has appeared in foreign literature, especially English, on Upper Asia. The committee, while heartily approving of the idea, has suggested that a catalogue of books and articles relating to that region and its inhabitants should be published in the

Proceedings of the society, with an introductory essay on the geography and ethnography of the country, together with accurate maps.

In the Proceedings of the Royal Geographical Society, April, 1876, there is a review of Thompson's *Marco Polo's Six Kingdoms or Cities in Java Minor* identified in Translations from the Ancient Malay Annals.

The Museum of Ethnology at Leipzig, founded upon the magnificent collections of Dr. Klemm, of Dresden, has published its third annual report, containing the reports of the treasurer and of the trustees, and a list of the members and of the additions during the year.

Friederich von Hellevall, who has just succeeded Dr. Peschel as editor of *Das Ausland*, is engaged in compiling a geography on the principles adopted by Élysée Reclus in his *Géographie Universelle*. The work, which is to appear in fifty numbers, is entitled *Die Erde und ihre Völker*, and is to be published at Stuttgart, by W. Spemann & Co.

The American Association for the Advancement of Science will meet at Buffalo, August 23d; a subsection of anthropology will then be formed. Immediately afterwards, September 4th, the International Convention of Archaeologists will meet in Philadelphia, where the finest display of American antiquities ever brought together is on exhibition in connection with the Centennial. The British Association will meet at Glasgow, September 6th. The International Congress of Anthropology and Prehistoric Archaeology will meet at Buda-Pesth, 4th to 11th of September. The French Association will meet at Clermont-Ferrand, August 19th. The annual meeting of the German Anthropological Society will be held in Jena from the 9th to the 11th of August. — O. T. MASON.

GEOLOGY AND PALÆONTOLOGY.

EXPLORATIONS BY WHEELER'S SURVEY. — In Mr. Gilbert's report we find an interesting chapter on the Colorado Plateau, which lies between the Rocky Mountain system and the Basin Range system at the east and west, and stretches northward to the Uintahs. The simplicity of its structure, he says, the thoroughness of its drainage, which rarely permits detritus to accumulate in its valleys, its barrenness, and the wonderful natural sections exposed in its cañons, conspire to render it indeed "the paradise of the geologist." Mr. Gilbert's studies supplement those of Newberry, Marcou, and Powell. This mountain system resembles the Appalachian in the absence of any great central axis, and in the general tendency to uniformity throughout, but differs widely in other respects. "In the Appalachians corrugation has been produced commonly by folding, exceptionally by faulting; in the Basin Ranges commonly by faulting, exceptionally by flexure." He believes that in the Appalachians the primary phenomena of mountain-building are superficial, and that in the Basin Ranges they are deep-seated, the superficial being

secondary; that such a force as has crowded together the strata of the Appalachians, whatever may have been its source, has acted in the Basin Ranges on some portion of the earth's crust beneath the immediate surface; and the upper strata, by continually adapting themselves, under gravity, to the inequalities of the lower, have assumed the forms we see. The geology of the Great Salt Lake is discussed at length, and in a way to excite fresh interest in the history of this wonderful lake.

MEEK'S INVERTEBRATE FOSSILS OF THE UPPER MISSOURI.—This splendid quarto volume has just been issued as volume ix. of the final reports of Hayden's United States Geological Survey of the Territories. It relates chiefly to fossil shells of the cretaceous and tertiary formations of the head-waters of the Missouri, which were largely collected by Dr. Hayden early in his explorations in the West. The different divisions of the cretaceous and tertiary formations of this region were originally established by the invertebrate remains herein described, and it therefore forms the basis of our knowledge of two of the most important formations in the West. As one of the series of volumes issued by the survey, and following those of Leidy and Cope on the fossil mammals, and of Lesquereux on the fossil plants, it contains a large mass of facts contributing toward the solution of one of the most difficult problems in western geology, namely, "the relations of the Lignitic group to the well-defined cretaceous formation immediately beneath it." The discussions by Mr. Meek of this vexed question will interest geologists. The work is illustrated by forty-five plates, with six hundred and twenty-nine pages of text; and from the carefully elaborated introductory essay, the full discussion of synonymy, the careful and detailed descriptions of the genera as well as species, it is evident that the work will add to the high reputation of the distinguished author, and be a classical contribution to American palæontology.

A FOSSIL SKUNK FROM THE BONE CAVES OF PENNSYLVANIA.—In a recent paper on the Dental and Cranial Characters¹ of *Mephitis*, Dr. Coues has described a supposed new species of fossil *Mephitis* from the bone caves of Pennsylvania, and has given detailed descriptions of the skulls and dentition of the different genera of this group. The *Mephitinæ*, embracing the "skunks," is, as is well known, restricted in its distribution to the two Americas, and its representatives are also known to be among the most variable, both in osteological and external characters, of American mammals. In speaking of the common skunk (*Mephitis mephitis*), Dr. Coues says that he is acquainted with no animal that varies more than this, and few that exhibit such remarkable differences, independently of age and sex. "Some specimens," he says, "are a fourth larger than others, and twice as heavy; and there is

¹ On the Cranial and Dental Characters of *Mephitinæ*, with Description of *Mephitis frontata*, n. sp. foss. By Dr. Elliott Coues, U. S. A. Bulletin U. S. Geological and Geographical Survey of the Territories, Second Series, No. 1, pp. 7-15. Washington: Government Printing Office. 1875.

a corresponding range in contour. Compared with an ordinary ratio of osteological variability, the discrepancies are almost on a par with those exhibited by the coloration of the animal when set over against the more constant markings of most animals." These variations are described somewhat in detail, in connection with a general description of the cranial characters of the species.

Dr. Coues recognizes among the *Mephitinæ* the three genera *Mephitis*, *Spilogale*, and *Conepatus*. The two first named differ not at all in their dental formulæ, while *Conepatus* has usually been considered as lacking the minute first premolar present in the others. Dr. Coues, however, affirms that it is present as a rule, though always minute, but is often either deciduous or abortive, and never functionally developed. Hence the main differences appear to relate to the general contour of the skull, for while Dr. Coues has described each form with great detail he has failed to give a contrasted summary of the differences that severally characterize these so-called genera, — an omission that detracts considerably from the availability of an otherwise excellent paper. While *Mephitis* and *Spilogale* seem to be hardly generically separable, *Conepatus* presents wider differences, especially in respect to the characters of the lower jaw.

No synonymy is formally presented in this connection, but it is mentioned incidentally that the *M. occidentalis* of authors is inseparable from *M. mephitica*. Of *Mephitis* proper only the single recent species *mephitica* is mentioned; of *Spilogale*, a single species only is noticed, *putorius* Linn., based on Catesby (= to the *M. Zorilla*, *bicolor*, and *interrupta* of recent authors), and of *Conepatus* also but a single species (*marputio* Gmel. = *mesoleuca* Licht.).

The supposed new fossil species here described seems to present no very tangible features. Its size is stated to be intermediate between various specimens of the recent *M. mephitica*, the only ostensible characters hence being the excessive tumidity and angulation of the vertex of the skull, and the vertical narrowing of the zygoma anteriorly. In view of the normal tumidity of the frontal region, and especially the tendency, so readily seen in any large series of the skulls of the common species, to a diseased and abnormal enlargement of this part, this alleged character has much less weight than it would otherwise have.

GEOGRAPHY AND EXPLORATION.

THE ISTHMUS OF TEHUANTEPEC. — We extract the following account from Sumichrast's notes on the birds of the isthmus in the fourth Bulletin of the United States National Museum. The contraction of the American continent between the ninety-fourth and ninety-fifth degrees of longitude west from Greenwich forms what is called, quite improperly, perhaps, the Isthmus of Tehuantepec, whose width between the mouth of the Rio Coatzacoalcos and the Bay of Ventosa is about one hundred and eighty miles.

In a physical point of view, the isthmus may be considered as divided into three parts : first, an eastern, extending from the Gulf of Mexico to the Puerta ; secondly, a central, from the Puerta to the Chivela ; and thirdly, a western, from the Chivela to the Pacific. The eastern part, formed principally of alluvial land and watered by the Coatzacoalcas and its affluents, has its largest portion covered with thick and damp forests, whose vegetation rivals the greatest beauties of tropical nature. The central region presents an undulating surface, embossed with innumerable *lomas*, or hills, which, rising gradually, unite on the western side with the mountains of the Sierra de los Mijes, and toward the east with those of the Sierra de Chimalapa. Although watered by numerous streams, it presents, nevertheless, but a scanty vegetation, essentially characterized by oaks on the side of Sarabbia, and palm-trees on the plateau of Chivela. The western division, or plains of the Pacific, is very dry, and its vegetable physiognomy presents a striking contrast to the rich plains on the Atlantic slope. Of the few rivers which flow through it, the most important are the Tehuantepec, Juchitan, Chicapa, and Ostula. These are so low during part of the dry season that the inhabitants of the villages and *ranchos* situated on their banks have no drinking-water but that which they draw out of holes dug in the sand.

RESOURCES OF THE BLACK HILLS. — In Mr. Jenney's Mineral Wealth, Climate, etc., of the Black Hills of Dakota, we have an apparently authentic account of the natural resources of this region. Compared with some of the world-renowned districts in California and Australia, the placers at present discovered are not remarkably rich, yet there are claims already opened and worked which are yielding a very good return for the labor employed. The reporter adds that the climate of the Black Hills is wonderfully healthy and invigorating, and that wood, water, and grass are everywhere abundant and of the best quality. "There is gold enough to thoroughly settle and develop the country, and, after the placers are exhausted, stock-raising will be the great business of the inhabitants, who have a world of wealth in the splendid grazing of this region."

SIBERIAN EXPLORATION. — Drs. Finsch and Brehm and Count Waldburg Zeil arrived at Ekaterinburg, April 5th, on their way to Siberia. Dr. Nordenskiöld's plan for following up his voyage of last summer from Norway to Siberia, is to start from Gothenburg July 7th, in a steamer capable of taking 10,000 *puds* weight of cargo. He will go up the Yenisei to Dudinko, and there take in cargo and return by the same route to Norway. The Russians on their part propose despatching a vessel from Yeniseisk down the river by way of the Sea of Kara and the North Sea, to St. Petersburg. The Society for the Encouragement of Russian Sea Trade have also commissioned Messrs. Dahl and Randsen, two experienced seamen, to make a detailed survey of the Obi Gulf and estuary.

EXPLORATION IN NEW GUINEA. — This great island offers one of the most promising fields at present open to the explorer, as its interior is still an absolute *terra incognita*. The ill success of Mr. Macleay's attempt to penetrate the interior by way of Fly River, was due to the unfavorable season of the year. Mr. O. C. Stone has been more successful, as he ascended the Mai-Kassa River, discovered and named by him the Baxter River, in the cooler season. The banks are sparsely populated, the natives being cannibalistic at times in their tastes. In his account of his adventures in the Ellengowan, a steamer of eighty tons, he describes the dugong, kangaroos, Megapodius (one of the nests of these fowl being ten feet high by ninety in circumference), birds-of-paradise, large snakes, and the vegetation of the shores. To the naturalist and botanist the shores of the Baxter River present features of rare interest when we take into consideration the comparative immunity from danger, combined with the ease with which they may be approached, both being considerations of no small importance. That the southern part of New Guinea is either cut up into a series of islands, or intersected by rivers and streams of considerable length, is beyond doubt.

At the meeting of the Royal Geographical Society, held May 8th, Mr. Stone read a paper on The Country and Natives of Port Moresby, New Guinea, and a paper on The Natives and Products of Fly River, New Guinea, by Signor L. M. D'Albertis. Sir Henry Rawlinson hoped that a "Cameron" for New Guinea would soon turn up, and that Mr. Young would be the coming explorer, and would force himself into the large and comparatively unknown regions of New Guinea.

MICROSCOPY.¹

POLARIZATION OF LIVING TISSUES. — A correspondent of *Science Gossip* has recently noticed that the tissues of a living shrimp are affected by the polariscope, giving most beautiful colors, which cannot be obtained by using the flesh after it has been boiled, and he desires to know whether any one else has observed this. Rev. E. C. Bolles, of Salem, Mass., has been accustomed for years, in his popular lectures on the microscope, to demonstrate this by exhibiting upon the screen small crustaceans or aquatic larvæ, illuminated by polarized light; and a finer screen-effect can hardly be conceived than the flashes of color that play over the large and well-defined image of the muscular fibres at every contraction connected with the movements of the living animal.

ARRANGING DIATOMS. — Dr. G. C. Morris, of Philadelphia, arranges diatoms with facility and success, by using the mechanical stage as a means of holding and moving the bristle which handles the diatoms, while the sub-stage prolonged upwards (through the opening of the regular stage) by means of a tube, serves as a stage to hold the object slide. An arm, attached by means of a socket to the stage, carries a small cork,

¹ Conducted by DR. R. H. WARD, Troy, N. Y.

through which is passed a needle, and the bristle is fastened to this needle in such a manner as to project about a quarter of an inch beyond its point. With this arrangement the objective can be readily focused upon the bristle-point, which can then be moved in any horizontal direction, while the object can be brought up to focus, or depressed below it, by means of the rack of the sub-stage.

A COMPACT COLLECTING CASE. — Mr. Kinne recommends the small leather pocket-cases used by physicians, as being convenient collecting cases, when only small quantities of microscopic objects are to be obtained.

WYTHE'S AMPLIFIERS. — Rev. J. H. Wythe, M. D., reported his experiments with amplifiers, at a recent meeting of the San Francisco Microscopical Society. Believing that late improvements in objectives had rendered it unreasonable to expect greater perfection in them than their present excellence furnishes (a conclusion which we can mention only under protest), he was led to look for future progress mainly in the eye-piece, or in intermediate arrangements of lenses. Having had no opportunity to use or examine the "amplifiers" mentioned in the journals, or the aplanatic searcher of Dr. Pigott, which is often used for a similar purpose, he had experimented independently upon the subject during the last two or three years. He arranged a strongly-magnifying eye-piece, consisting of a deep convex meniscus, in place of the ordinary field lens of the Huyghenian eye-piece, with good results. Afterwards he placed the amplifying lens below an ordinary negative eye-piece, using first a cylindrical lens of conical shape, with the lower and smaller end concave and the upper and larger end convex, and subsequently a double concave lens of $1\frac{1}{2}$ inches virtual focus. This last arrangement was most satisfactory, and seems to correspond somewhat to amplifiers used in the Eastern States. It is described, however, as increasing the amplification from four to eight times with such unqualifiedly good results in respect to light and definition, as have not been obtained by similar contrivances heretofore.

MICROSCOPY. — Mr. F. Kitton, an accomplished contributor to *Science Gossip*, objects strenuously to the terms microscopy and microscopist. He argues that there is no such science as microscopy, because its objects of study belong to zoölogy, botany, etc. Precisely the same statement might be made in regard to anatomy, physiology, and to histology, which he mentions in the same sentence without protest. All of these terms are too convenient to die, and the "microscopy" of *Science Gossip* itself is too good to be suppressed or dispersed by suicidal theories in regard to its name. Even as a word, microscopist is no worse than pianist or organist, and microscopy is as good as thermometry.

SCIENTIFIC NEWS.

— *Nature* for June 1st contains a brief biography, with a steel portrait, of Professor Wyville Thompson, the leader of the Challenger Expedition, which returned to England May 27th, after a voyage around the world of about three years and a half. The expedition, says *Nature*, although by no means sensational, has been thoroughly successful. The Challenger has steadily traversed a track of sixty-nine thousand miles and during her absence of three years and a half from England has established three hundred and sixty-two observing stations, at all of which the depth has been ascertained with the greatest possible accuracy, and at nearly all the bottom temperature has been taken, a sample of the bottom water has been brought up for physical examination and chemical analysis, a sufficient specimen of the bottom has been procured, and the trawl or dredge has been lowered to ascertain the nature of the fauna. At most of these stations serial soundings have been taken with specially devised instruments, to ascertain, by the determinations of intermediate temperatures and by the analysis and physical examination of samples of water from intermediate depths, the directions and rate of movement of deep-sea currents. The only untoward event was the death of Dr. Willemoes-Suhm, one of the naturalists of the expedition. An illustrated account of the voyage in two volumes is nearly ready for publication, and promises to be of unusual interest.

— Dr. Elliott Coues, U. S. A., lately attached to the Northern Boundary Survey, has lately been ordered on duty with Professor Hayden's Geological Survey of the Territories, his address being the office of the U. S. Geological Survey of the Territories, 509 Seventh Street, Washington, D. C. It is a matter of congratulation that Dr. Coues's time will as heretofore be devoted to zoölogical pursuits.

— E. Billings, for many years the able palæontologist of the Canadian Geological Survey, has recently died.

— *Rambles of a Naturalist in Egypt and other Countries*, by J. H. Gurney, Jr., is announced by Jarrold and Sons, London.

— A botanical section of the Boston Society of Natural History has been formed, which meets during the summer every Monday at four p. m.

— The first wing of the Peabody Museum of Natural History of Yale College is now completed, and part of the collections have been placed within it. This wing is situated on the southwest corner of Elm and High streets. It is built of brick, with ornaments of light Nova Scotia sandstone. The cost of the building was about \$140,000, and the cases will increase the expense to \$175,000. The museum is much the largest structure yet erected for the college. The exterior is of Philadelphia pressed brick and Nova Scotia stone, with a podium or base of East Haven brown stone. The architecture of the lower stories is especially massive, the structure increasing in lightness as it

rises. The construction is fire-proof throughout. There is an immense elevator, capable of taking up the largest fossils, which rises one hundred feet.

— The twenty-fifth meeting of the American Association for the Advancement of Science will be held at Buffalo, N. Y., beginning at ten o'clock A. M., on Wednesday, August 23d.

The address of Mr. F. W. Putnam, the Permanent Secretary, will be Salem, Mass., until *Saturday morning, August 19th*; after that time, and until the meeting has adjourned, Buffalo, N. Y.

The officers of the Buffalo meeting are the following: President, William B. Rogers, of Boston; Vice President, Section A, Charles A. Young, of Hanover; Vice President, Section B, Edward S. Morse, of Salem; Chairman of Permanent Subsection of Chemistry, G. F. Barker, of Philadelphia; Chairman of Permanent Subsection of Anthropology, L. H. Morgan, of Rochester; Permanent Secretary, F. W. Putnam, of Salem; General Secretary, T. C. Mendenhall, of Columbus; Secretary of Section A, Arthur W. Wright, of New Haven; Secretary of Section B, Albert H. Tuttle, of Columbus; Treasurer, Thomas T. Bouvé, of Boston.

The attention of chemists is specially directed to the fact that the Chemical Subsection, formed at the Hartford meeting, has been made a permanent organization. The attention of entomologists is directed to the action taken by the entomologists at the last two meetings, and to the annual meeting of the Entomological Club of the Association which will be held at Buffalo, on Tuesday, August 22d (the day preceding the meeting of the Association), at which all interested are invited to be present.

A Permanent Subsection of Anthropology was organized at Detroit, and a committee was appointed for the purpose of developing the subsection at the Buffalo meeting. Members interested in this department are specially requested to make known the formation of the subsection. A circular issued by the special committee will be sent by the Permanent Secretary on request. It is expected that special arrangements will be made for the Subsection to attend the Archæological Convention to be held in Philadelphia, on September 4th.

It was suggested at the last meeting that special efforts be made to bring the microscopists together at Buffalo in order to form a permanent organization, either as a subsection or as a club on the plan of the Entomological Club. From the interest already evinced by a number of leading microscopists definite action will, undoubtedly, be taken on the subject at the coming meeting. For special information on this subject, microscopists may address Dr. R. H. Ward, 53 Fourth St., Troy, N. Y.

— It is proposed to hold an International Convention of Archæologists, at Philadelphia during the Centennial, and in connection with the Centennial Exhibition, for the purpose of promoting acquaintance and

increasing the means of information in American Archæology and Ethnology. The "State Archæological Society of Ohio" will provide rooms for the Convention, and the first meeting will be held in the Ohio Building, at two o'clock, P. M., September 4, 1876. Those proposing to attend are requested to notify the Chairman of the Ohio Committee, Rev. S. D. Peet, Ashtabula, Ohio. At the meeting of the American Association for the Advancement of Science, at Buffalo, N. Y., August 23d, a Subsection of Anthropology will be formed. The Convention has been appointed near the close of the sessions of the "Association" in order that those who desire may conveniently attend both meetings.

—Messrs Longmans, Green, & Co., have recently published An Introduction to Animal Morphology and Systematic Zoölogy. Part I. Invertebrata. By Prof. Alexander Macalister. Macmillan & Co. have published The Geographical Distribution of Animals, by Alfred R. Wallace. 2 volumes, 8vo.

—The Third Bulletin (vol. ii.) of the United States Geological and Geographical Survey of the Territories has the following table of contents: Notes descriptive of some Geological Sections of the Country, about the Head-Waters of the Missouri and Yellowstone Rivers, by F. V. Hayden; Notes on the Tertiary and Cretaceous Periods of Kansas, by B. F. Mudge; Notes concerning a Contour Map of the United States, by Henry Gannett; The Flora of Southwestern Colorado, by T. S. Brandegee; Brief Synopsis of North American Earwigs, with an Appendix on the Fossil Species, List of the Orthoptera collected by Dr. A. S. Packard in Colorado and the Neighboring Territories during the Summer of 1875; Notice of a Small Collection of Butterflies made by Dr. A. S. Packard in Colorado and Utah in 1875, by S. H. Scudder; Notes on the Grammatical Structure of the Nez Percés Language, by George Ainslie.

—The Appalachian Club of Boston issued the first number of its journal under the title of *Appalachia*, about the middle of July. It contains a sketch map of the White Mountains, profile of Trapyramid, with other papers, and the proceedings of the club.

—Dr. Kidder's contributions to the Natural History of Kerguelen Island, made in connection with the United States Transit-of-Venus Expedition, in 1874-75, contains articles on the eggs of birds, by Drs. J. H. Kidder and E. Coues; on the botany, by Dr. Asa Gray; geology, by Drs. F. M. Endlich and Kidder; on the mollusks, by W. H. Dall; the insects, by Baron R. Ostensacken and Dr. H. A. Hagen; the crustaceans, by Prof. S. I. Smith; the annelids and echinoderms, by Prof. A. E. Verrill. The number concludes with a study of *Chionis minor*, with reference to its structure and systematic position, by J. H. Kidder and Elliott Coues.

—We have received a folio pamphlet of twenty-four pages, on the invertebrate animals of Travemünder Bay, by H. Lenz, being appendix

I to the Annual Report for 1874-75 of the Commission for the Scientific Investigation of the German Sea at Kiel. These reports are of much scientific and practical value, and it would be very desirable if the United States Government could have similar work done in connection with the Coast Survey.

— Mr. Julius Stoezzer, of the National Museum at Washington, died on the 13th of May, aged thirty-four years, leaving a wife and child. Mr. Stoezzer, at the time of his death, was unquestionably the most thoroughly trained and really scientific taxidermist in the country. A pupil of the celebrated Martin, a good comparative anatomist, an enthusiast in his profession; his very skeleton frames of boards and hoop-iron had more life and action in them than the completed inflations we are generally asked to call stuffed animals. The magnificent group of fur seals, now at the Centennial Exhibition, is one of his masterpieces, and is unequalled in any part of the world so far as those animals are concerned. Mr. Stoezzer's death is regretted by all who knew him, and it is felt that with him an artist as well as a preparator has passed away, who can hardly be replaced.

PROCEEDINGS OF SOCIETIES.

PHILOSOPHICAL SOCIETY OF WASHINGTON. — April 22. Major J. W. Powell read a paper on monoclinical folds in orographic geology, tending to show that the higher the strata were elevated above the general surface, the greater the proportional rapidity of their denudation or erosion. He also showed how by unequal elevation on two sides of a fault and general erosion, beds of unequal age might be brought into such close proximity as to lead to errors in identification. This was illustrated by the case of the Green River beds, referred by Cope, Lesquereux, and Hayden to different horizons as a whole, from specimens gathered from apparently identical strata within a few hundred yards of each other. While each investigator had rightly referred the organic remains submitted to his examination to their proper horizon, the error, according to the speaker, had arisen from supposing that the adjoining and apparently identical beds were really continuous; when, actually, faulting had taken place on three cross lines of fracture, with differing elevation and uniform erosion, thus bringing into almost exact parallelism, beds of different age.

A discussion followed in which the question of the thickness of the earth's crust was debated. Mr. Taylor, Major Powell and others, finding it difficult to reconcile the multifarious changes of level of small areas with a crust of great thickness, while Captain Dutton regarded a solid nucleus with a hydrothermal plastic layer between it and the outer crust as meeting the requirements of the case.

CAMBRIDGE ENTOMOLOGICAL CLUB. — March 10. Mr. Burgess de-

scribed some appearances in the pupæ of *Eudamus Tityrus*, by which he thought it might be possible to know the sex of the pupæ.

Mr. Mann described some great variations in the appearance of larvæ which afterwards produced female imagoes of *Anisopteryx pometaria*.

Mr. Scudder referred to the presence of *Gryllus domesticus* in several parts of the country, into which it had been introduced from various parts of Europe. He had not succeeded in an attempt to naturalize the species in Cambridge, the specimens which he had, that had come to Boston from some undetermined source, in an East India merchant-essel, having been destroyed by accident.

Upon the table lay an Entomologists' Bulletin in manuscript, which had been prepared by Mr. Mann, and contained the addresses of about three hundred North American entomologists, with a notice of the special pursuits of each, when known, and such other information of a similar kind as would be of interest to entomologists. This Bulletin was open to the inspection of all who wished to see it, and all were requested to communicate to Mr. Mann such information as would enlarge and freshen this record.

April 14, 1876. Dr. Hagen gave a very interesting account of the mode of gathering, and of some of the properties of amber.

Mr. Scudder exhibited specimens of *Cyaniris lucia*, *C. violacea*, *C. neglecta*, and *C. pseudargiolus* to illustrate a paper which he read, showing that these so-called species are probably only forms of one species, which must retain the name of *Cyaniris pseudargiolus*.

Dr. Hagen gave some information about an insect allied to *Mantispa* (but possessing an ovipositor), which he had lately received from Lieutenant Wheeler's Expedition, as having been caught at Fort Tejon, Southern California. This is the more interesting, as no Hemerobina, except its congeners and the species of the genus *Dila*, possess an ovipositor. The insect lives in wasps' nests.

Mr. Scudder said that in working up the Forficularians of North America, he had detected thirty-eight species; there are undoubtedly many more, especially in Mexico. Only fourteen species are found in the United States and only nine of these are indigenous. Mr. Scudder has prepared a synoptical table of the United States species for publication in *Psyche*.

Mr. Austin said that on the 26th of March he obtained at least twenty-eight species of Dytiscidæ in a small clay pit which had become filled with water. Some of the species occurred in immense numbers. Dr. Hagen suggested that the absence of fishes would account for the great abundance of these beetles.

ACADEMY OF SCIENCES, St. Louis.—May 1. Mr. Riley made a communication on the oviposition of *Leucania unipuncta*, or the Army-Worm Moth.

In his eighth Annual Report, the last forms of which were going

through the press, he had remarked that "at first view it seems singular that the eggs of an insect that appears in such countless myriads from Maine to Georgia, and from Virginia to Kansas, should have remained undiscovered either by farmers or entomologists. One of the obstacles that have stood in the way is, that, as soon as the worms have increased so prodigiously as to attract attention, their natural enemies become so multiplied that a very small per cent. of the worms entering the ground issue again as moths. A second reason is that during the season when the insect is not numerous, and attracts no attention, no one thinks of searching for the eggs. A third reason is that the moths that are reared indoors do not oviposit in confinement. I venture to suggest a fourth possible reason that has hitherto occurred to nobody: it is that the eggs are for the most part secreted where they are not easily seen."

Structure is a trustworthy guide to habit, and Mr. Riley had been led to this last conclusion by a study of the structure of the ovipositor of the moth in question. The time, place, and manner of oviposition in this species is quite important from the economic point of view, as the insect may readily be destroyed in the egg state by fire, if the conclusions drawn were correct.

Mr. Riley had recently been able to verify the correctness of his conclusions by direct observation, having witnessed the mode of oviposition on blue grass. The eggs are, as he surmised, secreted, being either glued in rows of from five to twenty in the groove which is formed by the folding of the terminal grass-blade, or in between the sheath and the stalk. More rarely they are pushed into crevices in the ground, especially at the base of the grass-stalk. The eggs are white, slightly iridescent, spherical, and only $\frac{2}{100}$ of an inch in diameter. They are fastened to each other and to the leaf, and covered along the exposed portion by a white, glistening, viscid substance. As they mature the color becomes more sordid or yellowish, and by the seventh day after deposition the brown head of the embryo shows distinctly through the shell. The larva hatches from the eighth to the tenth day, measures 1.7 mm. in length, is dull, translucent-white in color, with a large brown-black head, and is a looper, the two front pair of abdominal prolegs being atrophied. On account of its extremely small size and of the color resembling the pale bases of the grass-stalks near the ground, it is almost impossible to find them even where there are dozens to the square foot.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA. — March 21. Dr. Leidy called attention to a fragment of the lower jaw of a mastodon found on the Amazon by Dr. Isaac S. Coates, of Chester. The species was determined to be *Mastodon andium*.

Mr. Meehan spoke of the phenomenon of natural inarching among trees. He described and explained such an occurrence in the case of a hemlock growing in the neighborhood of Germantown.

Professor Cope placed on record a new type of insectivorous mammals. It is allied to the extinct rodent-like forms from the Bridger beds,

which are characterized by a prolonged growth of the incisors, having enamel only on one side. The incisors in the form under consideration have enamel on the front and back, but not on the side. The characters of the other teeth were given as they exist in the genera *Calamodon* and *Ectogamus*, in each of which two species are known. The relationship established by these genera between the Edentata and the other mammalia was alluded to. These forms are both from the Wasatch beds of New Mexico. The name *Tæniodonta* was proposed for the group indicated.

Dr. Koenig called attention to a mineral, probably tantolite, from North Carolina. The distinction between columbite and tantolite is difficult to determine. The peculiarities discovered by analysis were described at length and the distinctive characters indicated. Its specific gravity is 5.8.

April 4th. Prof. Burt G. Wilder, of Cornell University, made a communication upon the anatomy and development of the brain in fish-like vertebrates. After considering the taxonomic value of the brain, he spoke of the investigations of Huxley, Owen, and the continental naturalists, dwelling particularly upon the causes of the great inaccuracy in the figures of fishes' brains contained in the text-books. He had endeavored to ascertain how far the brains of fishes might be homologized with the typical brain described and figured in diagram by Huxley. The differentiation of the three typical cerebral vesicles was described, and the fact stated that while the typical description applies to all the higher vertebrate brains, neither the lateral ventricles nor the foramen of Munroe had been observed in the brains of fishes until recently found by Professor Wilder in the gar-pike. He had since found them in the lamprey and the hag-fish, in several sharks and skates, in sturgeons, in the spoon-bill sturgeon, in the mud-fish or *Amia*, and in several typical bony fishes. He showed in what way the nearly solid front mass of the adult shark's brain is formed from a thin-walled vesicle in the embryo. The structure of the brain in ganoids and teleosts was described, and the distinction indicated that in the latter, although the lateral ventricles and the foramen of Munroe are present, they are so small as to be almost invisible. We are forced back, therefore, in searching for the distinctive character of the ganoid brain, upon the chiasma of the optic nerves of Müller. In considering the taxonomic value of these characters, the belief was expressed that the structure of brains will be found to be less dependent upon external modifying circumstances than are other parts of the animal organization.

In conclusion, Professor Wilder exhibited and described the brain of *Chimæra*, and indicated its relations to the other groups spoken of. He regarded the brain as presenting characters intermediate between the sharks and skates, the ganoids and the batrachians with *Lepidosteus*.

Professor Cope called attention to the entire novelty of certain of the observations made by Professor Wilder, and suggested the direction of

further investigation of the subject, expressing the belief that the chiasma of the optic nerves would yet be found in the lowest of the typical bony fishes.

Professor Koenig placed on record an analysis of garnet from Yancey County, North Carolina. Mr. Roberts announced the finding of uranite at Wayne Station, Germantown.

Mr. Mather, Superintendent of the Centennial Aquaria, submitted for the inspection of the members living specimens of the grayling and a species of *Campostoma*, upon which explanatory remarks were made by Professor Cope.

Mr. Mather called attention to a fungus growing upon the *Campostoma*, which, he stated, would sooner or later prove fatal. Dr. Leidy explained that the growth mentioned was the *Achyla prolifera* of botanists, and described its development. Dr. Koenig suggested the application of salicylic acid for the destruction of the fungous growth. The president and Professor Frazer further spoke of the properties of salicylic acid.

Mr. A. H. Smith and Mr. Thaddeus Norris described the habits of a species of game fish inhabiting the Saginaw River.

ACADEMY OF SCIENCE, St. Louis. — April 3d. Professor Potter, Chairman of the Committee on Mound Exploration, made a partial report, as follows: The committee have examined and made a survey of five groups of mounds. Two hundred specimens of pottery have been obtained, of which one hundred and twenty-six are quite perfect, the remaining specimens being in a fair condition, and may be wholly or in part restored. The collection also embraces the skulls of twenty individuals, of which number one is complete, seven nearly so, the remaining twelve being in fragments of sufficient size to be of value. They have also obtained the leg and arm bones, and in some cases the vertebrae and other small bones, representing twelve individuals.

Mr. Theo. P. Gillespie, a gentleman recently arrived from Peru, was introduced to the members by Dr. Briggs, and exhibited a beautiful collection of pottery taken from the burial grounds of an ancient tribe of Peruvians. The graves from which the specimens were taken were in very dry drift sand near the sea-beach. The graves are supposed to belong to a tribe that was conquered by the Incas fifty or sixty years before the advent of Pizarro in Peru. Many bones were found, being preserved by the perfect dryness of the sand in which they were buried. The greater portion of these relics were found along the line of the Chimote and Huaraz Railroad, latitude 7° S., and with few exceptions they represent what are supposed to have been drinking-vessels. In several of the specimens the handle, which is hollow, arches over the top of the vessel, the two branches of the tube uniting in a single vertical tube of several inches in length. The ornamentation, both in form and color, was in many cases very striking and expressive. A small

mold of strongly-baked clay, — the negative of a human face, — containing within it the figure which it was designed to reproduce, was shown. The collection contains twenty-seven specimens. Three specimens of copper were also exhibited, namely, a finger-ring, a long needle with an eye, and a chisel with a smooth edge and battered head.

THE APPALACHIAN MOUNTAIN CLUB, Boston. — April 12th. Mr. S. H. Scudder read a paper on The Correct Name of the Mountain called Pequawket or Kiarsarge, which was followed by considerable discussion, in which Mr. Emery, of Exeter, N. H., quoted from a journal of Samuel Willard, an old scout, written in 1725, to prove that the country round about was formerly called Pequawket, and that should be the proper name of the mountain. Mr. George Fox argued that while this was a name of the territory, it should not be applied to the mountain at all. Mr. J. B. Henck, Jr., who has made a partial map of the mountain region, read a paper on The Construction of a New Map of the White Mountains. Mr. Warren Upham read a paper on The East Branch of the Pemigewassett, which he had visited the past summer; and Prof. E. C. Pickering made a communication on Professor Bond's Manuscripts relating to the White Mountains.

The first field meeting of the club will be held at North Conway, N. H., on the fourth Wednesday in July.

SCIENTIFIC SERIALS.¹

ARCHIV FÜR MIKROSKOPISCHE ANATOMIE. — On the Pulsating Ventral Sinus of Insects, by V. Graber. Comparative Developmental History of *Comatula mediterraniensis*, by Alex. Goette.

PETERMANN'S GEOGRAPHISCHER MITTHEILUNGEN. — March 21st. Cernik's Expedition through the Region of the Euphrates and Tigris. April 5th. Cameron's Journey across Africa, by E. Behm. Journey in New Zealand. Swedish, Russian, and Dutch Journeys to West Siberia.

ANNALS AND MAGAZINE OF NATURAL HISTORY. — June. Notes on Otto Hahn's Micro-Geological Investigation of *Eozoön Canadense*, by W. B. Carpenter. On the Identity in Type of the Annelids and Vertebrates, by C. Semper.

AMERICAN JOURNAL OF SCIENCE AND ARTS. — June. The Geological Survey of Brazil, by C. F. Hartt. On a New Sub-Order of Pterosauria, by O. C. Marsh. Notice of New Odontornithes, by O. C. Marsh. — July. The Colorado Plateau Province as a Field for Geological Study, by G. K. Gilbert. On a Disease of Olive and Orange Trees occurring in California in the Spring and Summer of 1875, by W. G. Farlow.

¹ The articles enumerated under this h. will be for the most part selected.

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